Appendix E

Quiz and Homework Sets

Quiz 1.1 – Average Rates of Change

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson1/quiz/question4.pg
Suppose that the graph of the function $y = f(x)$ passes through the points $(-2,9)$ and $(-1,4)$. On the interval $[-2,-1]$,

the net change in x is $\Delta x =$ ________,

the net change in y is $\Delta y =$ ________, and

the average rate of change in y is $\Delta y/\Delta x =$ ________.

2. (1 pt) alfredLibrary/AUCI/chapter1/lesson1/quiz/question5.pg
Let $S(t)$ be the amount of sales in dollars by a small business during the t-th week after January 1. Suppose sales on January 1 were 9666 dollars and sales 6 weeks later were 5496 dollars. Compute the following over the time interval $[0,6]$. Enter the units by typing the full words or phrases (e.g., feet per second).

(a) $\Delta t =$ ________ Units? ________

(b) $\Delta S =$ ________ Units? ________

(c) $\Delta S/\Delta t =$ ________ Units? ________

(d) Use the average rate of change in part (c) to estimate the sales during the 4th week after January 1. That is, estimate $S(4)$.

$S(4) \approx$ ________ Units? ________

Quiz 1.2 – Linear Functions

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/quiz/question3.pg
Write an equation for the line through the point $(4,4)$ with slope 7 in point-slope form $y - y_0 = m(x - x_0)$.

$y -$ _____ $=$ __________

2. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/quiz/question4.pg
Suppose the points $(5,10)$ and $(8,3)$ lie on the graph of a function f.

(a) Write an equation for the secant line through the points $(5,10)$ and $(8,3)$ in point-slope form $y = y_0 + m(x - x_0)$.

$y =$ _____ $+$ __________

(b) The slope of the secant line between $(5,10)$ and $(8,3)$ is __________.

(c) The average rate of change of f between $(5,10)$ and $(8,3)$ is __________.

3. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/quiz/question5.pg
Write the equation for the line $y - 5 = -3(x - 7)$ in the form $y = mx + b$, and enter your answer in this form.

____

The slope is __________

The y -intercept is __________

Quiz 1.3 – Derivatives of Linear Functions

1. **(1 point)** **—alfredLibrary/AUCI/chapter1/lesson3/quiz/question1p.pg—**
Suppose the slope of the graph of a function f at $x = 6.3$ is -8.

(a) The rate of change of f at $x = 6.3$ is ________.

(b) The slope of the line tangent to the graph of f at $x = 6.3$ is ________.

(c) The derivative of f at $x = 6.3$ is ________.

(d) $f'(6.3) =$ ________.

2. **(1 point)** **—alfredLibrary/AUCI/chapter1/lesson3/quiz/question2p.pg—**
The first derivative of $y = 9x - 8$ is $y' =$ ________.

The second derivative of $y = 9x - 8$ is $y'' =$________.

3. **(1 point)** **—alfredLibrary/AUCI/chapter1/lesson3/quiz/question2pet.pg—**
If $y = -4x + 7$, then

$y' =$ ________, and

$y'' =$________.

4. **(1 point)** **—alfredLibrary/AUCI/chapter1/lesson3/quiz/question3pet.p**
Suppose the temperature of a beaker of water t minutes after heat is applied is $T(t) = 6t + 40$ degrees Celsius. Include **units** with your answers and enter rate units as fractions. Type degC for degrees Celsius, min for minutes, and min^2 for square minutes.

(a) The rate at which the temperature is increasing is $T'(t) =$ ________.

(b) The rate at which the rate is increasing is $T''(t) =$ ________.

Quiz 1.4 – Integrals of Constant Functions

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson4/quiz/question1.pg
In each part, choose the letter from the dropdown menu that corresponds to the most accurate description of the given statement.

? 1. $\int 6\,dx$
? 2. $(6x-2)'$
? 3. $6x-2$
? 4. $\int_{-6}^{9} 6\,dx$

A. A family of functions whose derivatives are $y=6$
B. The derivative of the function $y=6x-2$
C. The net area bounded by $y=6$ on the interval $[-6,9]$
D. An antiderivative of $y=6$
E. None of the above

2. (1 pt) alfredLibrary/AUCI/chapter1/lesson4/quiz/question4p.pg
Use the Fundamental Theorem of Calculus to evaluate the definite integral.

$$\int_{9}^{64} 31\,dx = \underline{\qquad}\Big|_{\_\_}^{\_\_} = \_\_$$

3. (1 pt) alfredLibrary/AUCI/chapter1/lesson4/quiz/question5p.pg

The net area of the shaded region is given by

$$\int_{\_\_}^{\_\_} \_\_\,dx = \_\_\Big|_{\_\_}^{\_\_} = \_\_$$

Quiz 1.5 – Rectilinear Motion

1. (1 point) —alfredLibrary/AUCI/chapter1/lesson5/quiz/question1p.pg—
True or False: Type 't' for True or 'f' for False. Notice that your number of attempts is limited.

Suppose an object is moving in rectilinear motion.

___ (a) The displacement and the total distance traveled are always equal.

___ (b) The velocity and the speed are always equal.

___ (c) If the velocity and acceleration have the same sign, then the object is speeding up.

___ (d) If the velocity and acceleration have different signs, then the object is slowing down.

___ (e) The velocity of the object at a given time is equal to the slope of the position curve at that time.

___ (f) The acceleration of the object at a given time is equal to the derivative of the velocity at that time.

2. (1 point) —alfredLibrary/AUCI/chapter1/lesson5/quiz/question3.pg—

(Include **units** *with your answers. Enter (without quotes) 'ft' for feet, 's' for seconds, and '$s^{2\prime}$ forsquareseconds.)*

Ifthepositionofanobjectisgivenbys$(t) = -67t + 7$ *feet, then at* $t = 6$ *seconds,*

(a) the velocity of the object is ________.

(b) the speed of the object is ________, *and*

(c) the acceleration of the object is ________.

3. (1 point) —alfredLibrary/AUCI/chapter1/lesson5/ball39pet.pg—
For this problem, upward will be considered the positive direction. The acceleration due to gravity is $-9.81\ \frac{\text{m}}{\text{s}^2}$.

(a) The general equation for the velocity of an object tossed upward is

$v(t) = \int$ ___ = ___ *m/s*

(b) If a ball is tossed upward with initial velocity $34\ \frac{\text{m}}{\text{s}}$, *then we can find the unknown constant C. In this case, the velocity function is*

$v(t) =$ ___ *(Include* **units***.)*

(c) The net change in the ball's velocity from time 1.5 s *to time* 3.25 s *is (include* **units** *in the last blank)*

$v($ ___ $) - v($ ___ $) =$ ___ $\int$ ___ ___ = ___

(d) To find the time at which the ball reaches its maximum height, we must solve the equation ___ = 0. *Therefore, the maximum height occurs at* $t =$ ___ *(Include* **units***.).*

Quiz 2.1 – Derivatives of Quadratic Functions

1. (1 point) —alfredLibrary/AUCI/chapter2/lesson1/quiz/TFquestion1pet.pg—

For each statement, type T for true or F for false. Assume that the given derivatives exist. Notice that you have a limited number of attempts.

___ (a) The derivative of a function at a point P is the slope of the tangent line at P.

___ (b) The derivative of a function at a point P is the instantaneous rate of change of the function at P.

___ (c) The average rate of change of a function between two points P and Q is the slope of the secant line between P and Q.

___ (d) The derivative of a function at a point P can be approximated by the average rate of change between P and a nearby point Q.

___ (e) The derivative of a function at a point P can be found by "sneaking up" on the slope of the tangent line using slopes of secant lines.

2. (1 point) —alfredLibrary/AUCI/chapter2/lesson1/table.pg—

For the function $f(x) = 2x^2 - 2x + 8$, compute the average rates of change for points closer and closer to and on both sides of $x_0 = -3$.

(HINT: $\frac{\Delta y}{\Delta x} = \frac{f(x) - f(-3)}{x-(-3)}$. Use the table feature on your calculator.)

x -2.9	-3.1	-3.01	-3.001	$\rightarrow$	-3	$\leftarrow$	-2.999	-2.99
$\frac{\Delta y}{\Delta x}$ ___	___	___	___	$\rightarrow$	???	$\leftarrow$	___	___

Estimate $f'(-3) =$ ____

3. (1 point) —alfredLibrary/AUCI/chapter2/lesson1/quiz/question2pet.pg—

Let $f(x) = -5x^2 - 8x - 2$.

(a) What is the slope of the tangent line to the graph of f at $x = -5$? (Use the formula for the derivative of a quadratic.)

$f'(-5) =$ ________

(b) At which x does f have a maximum value (highest point)?

$x =$ ________

(c) What it the maximum value of f?

$y =$ ________

(d) What is the slope of the tangent line at the maximum value?

Slope = ________

Quiz 2.2 – Analyzing Quadratic Functions

1. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quiz/question4pet.pg—
Use the quadratic formula to solve the quadratic equation

$$2x^2 - 5x - 6 = 0$$

Solutions (separate by commas): $x =$ ______

2. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quiz/question13pet.pg—
NASA launches a rocket at $t = 0$ seconds. Its height, in meters above sea-level, as a function of time is given by $h(t) = -4.9t^2 + 322t + 297$.

(a) How high above sea level is the launch pad? (HINT: Find the y-intercept.)

Launch pad is ______ meters above sea level.

(b) What is the maximum height of the rocket above sea level? (HINT: Find the vertex.)

Maximum height is ______ meters above sea level.

(c) Assuming that the rocket will splash down into the ocean, at what time does splashdown occur? (HINT: Find a t-intercept.)

Splashdown occurs at ______ seconds.

3. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quad3p.pg—
Suppose that a particle in rectilinear motion moves according to the function $s(t) = t^2 - 7t + 35$, where s is in meters and t is in seconds.

(a) Find the velocity function at time t.

$v(t) =$ ______ meters per second

(b) What is the velocity after 3 seconds?

$v(3) =$ ______ meters per second

(c) Find all values of t for which the particle is at rest. (If there are no such values, enter 0. If there are more than one value, list them separated by commas.)

$t =$ ______ seconds

(d) Use interval notation to indicate when the particle is moving in the positive direction. Enter inf for ∞, or enter -inf for $-\infty$. (If the particle is never moving in the positive direction, enter .)

Moving in positive direction on the interval ______

Quiz 2.3 – Definition and properties of the derivative

1. **(1 pt) alfredLibrary/AUCI/chapter2/lesson3/quiz-/differencequotient1pet.pg**

Compute the derivative of $f(x) = 7x^2$ at $x_0 = 6$ using the limit definition of the derivative at a point.

(HINTS: To enter Δx, type deltax (with no spaces). Write out your work on paper first, then enter your answers. Follow the step-by-step instructions. Copy and paste as much as you can to avoid typing errors. Check your answers frequently.)

$$f'(6) = \lim_{\Delta x \to 0} \frac{f(6+\Delta x) - f(6)}{\Delta x}$$

Substitute $6 + \Delta x$ and 6 into f:

$$= \lim_{\Delta x \to 0} \frac{\_\_\_\_ - \_\_\_\_}{\_\_\_\_}$$

FOIL and eliminate parentheses in the first term of the numerator:

$$= \lim_{\Delta x \to 0} \frac{\_\_\_\_\_\_\_\_\_\_ - \_\_\_\_}{\_\_\_\_}$$

Cancel like terms in the numerator:

$$= \lim_{\Delta x \to 0} \frac{\_\_\_\_\_\_\_\_\_\_}{\_\_\_\_}$$

Cancel like factors in the numerator and denominator:

$$= \lim_{\Delta x \to 0} \_\_\_\_\_\_\_\_$$

Set Δx equal to 0:

$=$________

Now check your answer by using the derivative formula for a quadratic...

2. **(1 pt) alfredLibrary/AUCI/chapter2/lesson3/quiz-/differencequotient2pet.pg**

Compute the derivative of $f(x) = 3x^2$ using the limit definition of the derivative function.

(HINTS: To enter Δx, type deltax (with no spaces). Write out your work on paper first, then enter your answers. Follow the step-by-step instructions. Copy and paste as much as you can to avoid typing errors. Check your answers frequently.)

$f'(x)$

$$= \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

Substitute $x + \Delta x$ into f:

$$= \lim_{\Delta x \to 0} \frac{\_\_\_\_ - \_\_\_\_}{\_\_\_\_}$$

FOIL and eliminate parentheses in the first term of the numerator:

$$= \lim_{\Delta x \to 0} \frac{\_\_\_\_\_\_\_\_\_\_ - \_\_\_\_}{\_\_\_\_}$$

Cancel like terms in the numerator

$$= \lim_{\Delta x \to 0} \frac{\_\_\_\_\_\_\_\_\_\_}{\_\_\_\_}$$

Cancel like factors in the numerator and denominator:

$$= \lim_{\Delta x \to 0} \_\_\_\_\_\_\_\_$$

Set Δx equal to 0:

$=$ ________

Now check your answer by using the derivative formula for a quadratic...

Quiz 2.4 – Analyzing Cubic Functions

1. (1 point) —alfredLibrary/AUCI/chapter2/lesson4/quiz/grouping1pet.pg—
Use the method of grouping to factor the cubic completely:

$x^3 - 7x^2 - 36x + 252 =$ __________

(HINT: Notice that $252 = 36 \cdot 7$.)

2. (1 point) —alfredLibrary/AUCI/chapter2/lesson4/quiz/cubiczeros1pet.pg—
Find a real zero of the polynomial

$$P(x) = x^3 - 5x + 2$$

by using the "guess-and-check" method with some small positive and negative integers. Then use long division to get a quadratic factor and use it to find any remaining zeros.

If the cubic has less than three real zeros, then input them in the boxes from left to right and leave the remaining boxes blank. Enter EXACT answers only (no decimal approximations).

In increasing order, from smallest to largest, the real zeros are

$x_1 =$ ___ $x_2 =$ ___ $x_3 =$ ___

3. (1 point) —alfredLibrary/AUCI/chapter2/lesson4/quiz/question7pet.pg—
Suppose that $f(x) = x^3 - 7x^2 + 2$.

(a) List all the critical points of f. If there are no critical points, then enter the word NONE:
$x =$ ______

(Now perform a number-line sign test for the derivative function.)

(b) Use **interval notation** to indicate where f is increasing:
____

(c) Use interval notation to indicate where f is decreasing:
____

(d) List the x-values of all local maxima of f. If there are no local maxima, then enter the word NONE:
$x =$ ______

(e) List the x-values of all local minima of f. If there are no local minima, then enter the word NONE:
$x =$ ______

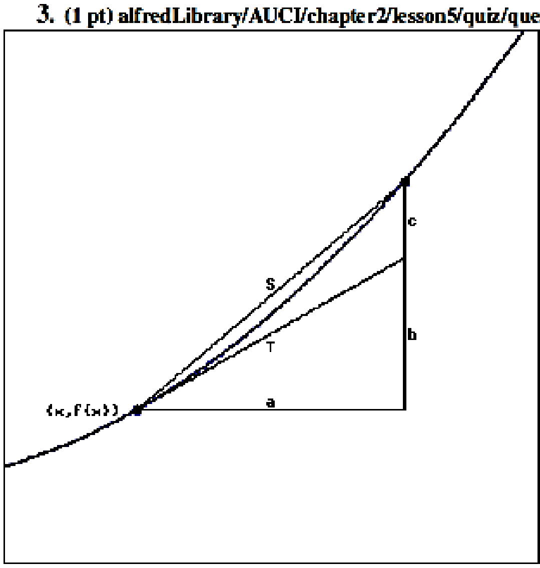
Quiz 2.5 – Linear Approximation

1. **(1 pt) alfredLibrary/AUCI/chapter2/lesson5/quiz/question9pet.pg**
If $y = 2x^3 - 9x^2 - 9x$, then $\frac{d^2y}{dx^2} =$ ________.

(Complete this problem on paper first so you can practice writing Leibniz notation.)

2. **(1 pt) alfredLibrary/AUCI/chapter2/lesson5/quiz/question5.pg**
If the point $P = (1, -8)$ is on the graph of a function, and the slope of the graph at P is -8, then the slope-intercept form of the tangent line at P is $y =$ ________.

3. **(1 pt) alfredLibrary/AUCI/chapter2/lesson5/quiz/question2pet.pg**



In the figure above, the function f is graphed in blue along with a tangent line and a secant line, both passing through through the point $(x, f(x))$. Using a horizontal disance a, we measure off a portion of the tangent line of length T and a portion of the secant line of length S. In the notation that we use for calculus,

the length Δx is equal to

- A. a
- B. b
- C. c
- D. S
- E. T
- F. a+b
- G. a+c
- H. b+c

the length dx is equal to

- A. a
- B. b
- C. c
- D. S
- E. T
- F. a+b
- G. a+c
- H. b+c

the length Δy is equal to

- A. a
- B. b
- C. c
- D. S
- E. T
- F. a+b
- G. a+c
- H. b+c

and the length dy is equal to

- A. a
- B. b
- C. c
- D. S
- E. T
- F. a+b
- G. a+c
- H. b+c

4. **(1 pt) alfredLibrary/AUCI/chapter2/lesson5/quiz/question4.pg**
Let $y = -5x^2$.

If $x = 7$ and $\Delta x = 0.85$, then $\Delta y =$___ and $dy =$___.

Quiz 2.6 – Integrals of Linear and Quadratic Functions

1. (1 point) —alfredLibrary/AUCI/chapter2/lesson6/quiz/question1pet.pg—
Recall the antiderivative formulas for constant, linear, and quadratic functions:

$$\int m\,dx = mx + C$$
$$\int (ax+b)\,dx = \frac{1}{2}ax^2 + bx + C$$
$$\int (ax^2+bx+c)\,dx = \frac{1}{3}ax^3 + \frac{1}{2}bx^2 + cx + D$$

Evaluate the following indefinite integrals:

(a) $\int -4\,dx =$ ________

(b) $\int (-8x-4)\,dx =$ ________

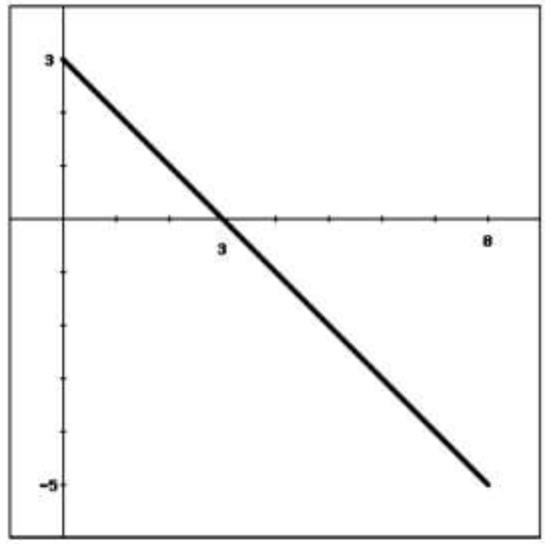
(c) $\int (7x^2-8x-4)\,dx =$ ________

2. (1 point) —alfredLibrary/AUCI/chapter2/lesson6/quiz/question4pet.pg—
Evaluate the following definite integrals using the Fundamental Theorem of Calculus:

(a) $\int_6^{11} 5\,du =$ ___ | ____ = ______

(b) $\int_{-3}^{-2} (4x+5)\,dx =$ ______ | ____ = ______

3. (1 point) —alfredLibrary/AUCI/chapter2/lesson6/quiz/question5pet.p



(Click on graph to enlarge)

Suppose that the graph represents the velocity (in m/s) of an object in rectilinear motion. Set up and evaluate the following on the interval $[0,8]$. Use geometry if possible. The final answer in each part requires **units**. (HINT: First find the slope-intercept equation of the velocity line.)

(a) Displacement = $\_\_\int\_\_$ ____ $dx =$ ____

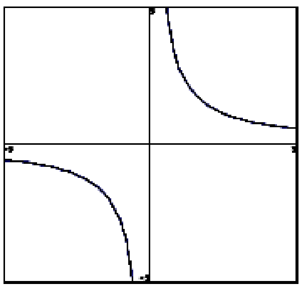
(b) Total distance traveled = $\_\_\int\_\_$ ____ $dx =$ ____

Quiz 3.1 – Power Functions

1. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/quiz/question22pet.pg

Match the graphs with the corresponding formulas. You should be able to recognize the basic shapes of these graphs from memory.

- ? 1. x^2
- ? 2. $\frac{1}{x}$
- ? 3. x
- ? 4. x^3
- ? 5. $\sqrt{x}$
- ? 6. $\frac{1}{x^2}$
- ? 7. $x^{\frac{1}{3}}$



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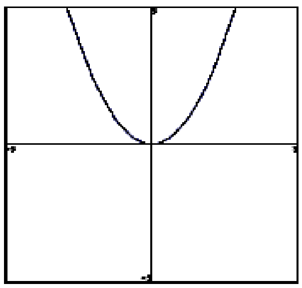

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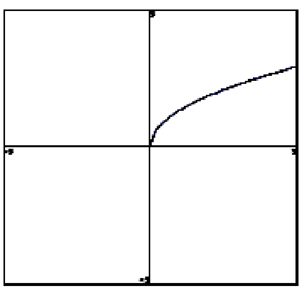

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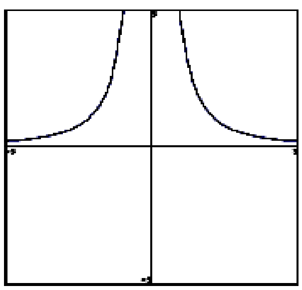

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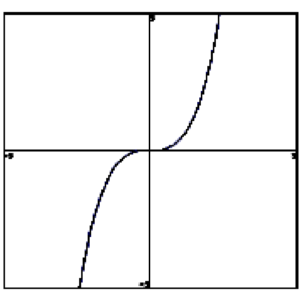

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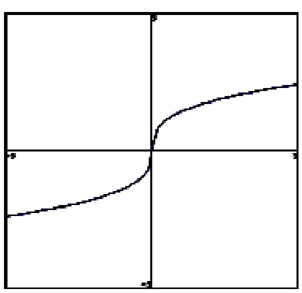

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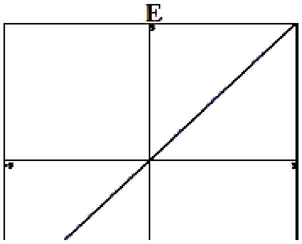


2. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/quiz/question2pet.pg

(a) Rewrite as a power function using a single exponent:

$x^{-6}x^5 = x^{\_\_}$ (the answer blank is for the exponent only)

(b) Rewrite as a power function using a single exponent:

$(x^3)^{-8} = x^{\_\_}$ (the answer blank is for the exponent only)

(c) Rewrite as a power function using a coefficient and a single exponent:

$$\frac{5}{7\sqrt[6]{x^9}} = \_\_x^{\_\_}$$

3. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/quiz/power4pet.pg

Use the power rule and the constant multiple rule to compute the following derivatives. It may be be necessary to rewrite some of the functions in the form ax^p.

(a) $\frac{d}{dx}\left(13x^{15}\right) =$ __________

(b) $\frac{d}{dx}\left(-11x^{-5}\right) =$ __________

(c) $\frac{d}{dx}\left(\frac{-11}{9x^7}\right) =$ __________

(d) $\frac{d}{dx}\left(-11x^{0.3}\right) =$ __________

Quiz 3.2 – Polynomial Functions

1. (1 point) —alfredLibrary/AUCI/chapter3/lesson2/prob1p.pg—

Factor to find the **EXACT** zeros (x -intercepts) of the function below. If there is more than one zero, then enter them as a comma-separated list. Do not round your answers.

$f(x) = \left(x^2+2x-5\right)\left(x^3+0x^2-4x\right)$

$x =$ ________

2. (1 point) —alfredLibrary/AUCI/chapter3/lesson2/quiz/question11pet.pg—

Compute each of the following for the polynomial

$$f(x) = -7x^8+8x^5+5x^3-4x.$$

(a) $f'(x) =$ ________

(b) $f''(x) =$ ________

(c) $f'(5) =$ ________

3. (1 point) —alfredLibrary/AUCI/chapter3/lesson2/quiz/question4pet.pg—

Find the critical points of the function

$$f(x) = 2x^3-3x^2-72x.$$

If there is more than one critical point, then enter your answers separated by commas.

$x =$ ________

4. (1 point) —alfredLibrary/AUCI/chapter3/lesson2/quiz/question3pet

Evaluate each of the following limits to determine the end behavior of the specified polynomial. If the limit is ∞, then enter 'INF', and if the limit is -∞, then enter '-INF'.
(HINT: You only need to look at the term with the highest power.)

(a) $\lim_{x\to+\infty}(7x^5+11x-4) =$ ________

(b) $\lim_{x\to-\infty}(7x^5+11x-4) =$ ________

(c) $\lim_{x\to+\infty}(-4x^9+7x^3-5) =$ ________

(d) $\lim_{x\to-\infty}(-4x^9+7x^3-5) =$ ________

Quiz 3.3 – Composite Functions

1. (1 point) —alfredLibrary/AUCI/chapter3/lesson3/quiz/comp1pet.pg—

Let $f(x) = 5x^2 + 8$, and let $r(x) = \sqrt{8x}$ for $x > 0$. Find a simplified formula for the composite function $f(r(x))$.

$f(r(x)) =$ ______ for $x > 0$.

2. (1 point) —alfredLibrary/AUCI/chapter3/lesson3/quiz/chain0pet.pg—

If $y = 5\left(8x^2 - 3x + 4\right)^{13}$, then by the chain rule,

$$\frac{dy}{dx} = \_\_ \left(\_\_ \right) \_\_ \left(\_\_ \right)$$

3. (1 point) —alfredLibrary/AUCI/chapter3/lesson3/quiz/chainquotient1

If

$$f(x) = \frac{-8}{\sqrt[16]{(5x^2 - x - 2)}} = -8\left(5x^2 - x - 2\right) \_\_$$

then by the chain rule,

$$f'(x) = \_\_ \left(\_\_ \right) \_\_ \left(\_\_ \right)$$

Quiz 3.4 – Products of Functions

1. (1 pt) alfredLibrary/AUCI/chapter3/lesson4/quiz/product0pet.pg

If $h(x) = (4+7x+7x^2)\left(-7x+5x^5-5x^7\right)$ then $h(x) = f(x)g(x)$ where
$f =$ __________
and
$g =$ __________
Using the product rule
$h'(x) =$ __________ * __________ + __________ * __________

2. (1 pt) alfredLibrary/AUCI/chapter3/lesson4/quiz/product3pet.pg

According to the product rule, if $y = x^6\sqrt{x^2+5x+10}$,

then $y' =$ ________________________________.

(Don't forget to use the chain rule when you differentiate the radical factor.)

3. (1 pt) alfredLibrary/AUCI/chapter3/lesson4/quiz/product2pet.pg

Let $f(x) = \frac{12x^2+3x}{7x-8}$. Rewrite f as a product, then use the product and chain rules to compute $f'(x)$. (We will eventually derive a "quotient rule" for the derivative of a quotient function.)

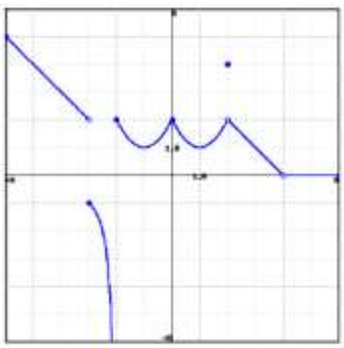
$f'(x) =$ ________________________________

Quiz 3.5 – Piecewise Functions

1. (1 point) —alfredLibrary/AUCI/chapter3/lesson5/quiz/question2.pg—
At which of the following could a function fail to be differentiable? There may be more than one correct answer, so check all that apply.

- A. A corner.
- B. A vertical tangent.
- C. A jump.
- D. A hole.

2. (1 point) —alfredLibrary/AUCI/chapter3/lesson5/quiz/question2pet.pg—



(a) Recall, a function is not continuous at a point if its graph has a break, jump, or hole at that point. Use the graph above to find the x-values for which the function is NOT continuous. Enter your answer as a comma-separated list: $x =$ _____

(b) Recall, a function is not differentiable at a point if it is not continuous at that point, or if its graph has a sharp change in direction or an infinite slope at that point. Use the graph above to find the x-values for which the function is NOT differentiable. Enter your answer as a comma-separated list: $x =$ _____

Note: *You can click on the graph to enlarge the image.*

3. (1 point) —alfredLibrary/AUCI/chapter3/lesson5/quiz/limits88pet.pg

Let $f(x) = \begin{cases} 4x-3, & \text{if } x \le 3 \\ -7x+b, & \text{if } x > 3 \end{cases}$

Find the correct value of b that makes the function $f(x)$ continuous everywhere:

$b =$ _____

(HINT: The two pieces of the graph must connect at $x = 3$.)

Now for fun, try to graph $f(x)$.

4. (1 point) —alfredLibrary/AUCI/chapter3/lesson5/quiz/limits99pet.pg

Let $f(x) = \begin{cases} x^2-4x+3, & \text{if } \quad x \le -2 \\ ax+b, & \text{if } \quad x > -2 \end{cases}$

Find a and b such that the function $f(x)$ is differentiable everywhere.

$a =$ _____
$b =$ _____

(HINT: First use differentiability to find a. Then use continuity to find b.)

Quiz 3.6 – Integrals of Polynomials

1. (1 point) —alfredLibrary/AUCI/chapter3/lesson6/quiz/question1pet.pg—
Match the rule with its formula:

? 1. Sum rule for integrals
? 2. Difference rule for integrals
? 3. Constant multiple rule for integrals
? 4. Power rule for integrals

A. $\int x^n dx = \frac{1}{n+1}x^{n+1} + C$
B. $\int f(x)g(x)dx = \int f(x)dx \int g(x)dx$
C. $\int (f(x)+g(x))dx = \int f(x)dx + \int g(x)dx$
D. $\int (f(x)-g(x))dx = \int f(x)dx - \int g(x)dx$
E. $\int x^n dx = \frac{1}{n+1}x^{n+1} + C, n \neq -1$
F. $\int kf(x)dx = k\int f(x)dx$
G. None of the above

2. (1 point) —alfredLibrary/AUCI/chapter3/lesson6/quiz/question44pet.pg—
Evaluate the definite integral:

$$\int_1^3 (y^8 - 5y^4 + 2y^3)\, dy = \underline{\qquad\qquad}$$

3. (1 point) —alfredLibrary/AUCI/chapter3/lesson6/quiz/question33pet.
Evaluate the indefinite integral:

$$\int \left(\frac{8}{x^4} - \frac{6}{x^6} + 12\right) dx = \underline{\qquad\qquad}.$$

4. (1 point) —alfredLibrary/AUCI/chapter3/lesson6/quiz/flow229pet.pg–
The function $W'(t) = 12t^2 - 36t + 32\ \frac{\text{cc}}{\text{min}}$ measures the RATE at which water is flowing through a pipe at time t. The net amount of water that has flown through the pipe from time $t = 3$ minutes to time $t = 6$ minutes is given by

$$W(\ \_\_\ ) - W(\ \_\_\ ) = \_\_\int\_\_\ \underline{\qquad\qquad}\ dt$$

By the Fundamental Theorem, the net flow of water over this time period is

$$\underline{\qquad\qquad}\Big|\underline{\qquad} = \underline{\qquad\qquad\qquad}$$ (include u

Quiz 4.1 – Analyzing Rational Functions

1. (1 point) —alfredLibrary/AUCI/chapter4/lesson1/quiz/question2pet.pg

Let $f(x) = \frac{(x+6)(x+3)^5(x-1)^4}{(x+3)^3(x-1)^5(x-4)^3}$. Enter the correct values for the requested information. Enter 'None' if necessary, and use a comma-separated list for multiple answers.

(a) Domain is all real numbers except $x =$ __________

(b) x -intercept(s) at $x =$ __________

(c) y -intercept at $y =$ __________

(d) Vertical asymptotes(s) at $x =$ __________

(e) Holes at $x =$ __________

2. (1 point) —alfredLibrary/AUCI/chapter4/lesson1/quiz/graphanalysis

Let $f(x) = \frac{x^2+16x+63}{x^2+8x+15}$.

(a) Domain is all real numbers except $x =$ __________.

(b) y -intercept at $y =$ __________.

(c) x -intercept(s) at $x =$ __________.

(d) Vertical asymptote(s) at $x =$ __________.

Quiz 4.2 – Horizontal and Vertical Asymptotes

1. (1 point) —alfredLibrary/AUCI/chapter4/lesson2/quiz/question1.pg—
Find the horizontal asymptotes of each function, if any, by setting up and evaluating limits at infinity and negative infinity. Enter the word 'none' if the function has no horizontal asymptotes. Complete this problem on paper first so you can practice writing limit notation.
(HINT: You only need to consider the terms with the highest powers in the numerator and denominator.)

(a) $f(x) = \frac{-6x^2+5x-9}{-3x^2-8x-1}$

Horizontal Asymptote(s) at $y =$ ___

(b) $f(x) = \frac{-6x+5x-9}{-3x^2-8x-1}$

Horizontal Asymptote(s) at $y =$ ___

(c) $f(x) = \frac{-6x^6+5x-9}{-3x^2-8x-1}$

Horizontal Asymptote(s) at $y =$ ___

2. (1 point) —alfredLibrary/AUCI/chapter4/lesson2/quiz/question2.pg—

Analyze the behavior of the function $y = \frac{7x+35}{x^2-7x+12}$ near the vertical asymptote $x = 4$ by analyzing the signs on either side of the asymptote. Enter 'inf' if the limit is ∞, enter '-inf' if the limit is $-\infty$, and enter 'dne' if the limit does not exist.

(a) $\lim_{x \to 4^-} \frac{7x+35}{x^2-7x+12} =$ _________

(b) $\lim_{x \to 4^+} \frac{7x+35}{x^2-7x+12} =$ _________

(c) $\lim_{x \to 4} \frac{7x+35}{x^2-7x+12} =$ _________

Quiz 4.3 – Continuity and L'Hôpital's Rule

1. **(1 pt)** alfredLibrary/AUCI/chapter4/lesson3/quiz/question1.pg
True or False (note that you have a limited number of attempts):

[?] If f is continuous at $x = 2$, then f is differentiable at $x = 2$

[?] If f is differentiable at $x = 2$, then f is continuous at $x = 2$.

[?] If f is continuous at $x = 2$, then $\lim_{x\to 2} f(x) = f(2)$

2. **(1 pt)** alfredLibrary/AUCI/chapter4/lesson3/quiz/question2pet.pg
True or False (note that you have a limited number of attempts):

[?] L'Hospital's Rule can be used for the limit of any rational function.

[?] L'Hospital's Rule can only be used for indeterminate forms of the type $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$.

[?] L'Hospital's Rule can be used to compute $\lim_{x\to -7} \frac{x^2+14x+48}{x^2+13x+42}$

[?] L'Hospital's Rule can be used to compute $\lim_{x\to -7} \frac{x^2+14x+49}{x^2+13x+42}$

3. **(1 pt)** alfredLibrary/AUCI/chapter4/lesson3/quiz/lhopitals1pet.pg

Suppose we want to know the behavior of the rational function $y = \frac{-3x^2+17x-10}{x-5}$ near $x = 5$ (there is a hole at that point). That is, suppose we want to find $\lim_{x\to 5} \frac{-3x^2+17x-10}{x-5}$. Use L'Hopital's rule to evaluate this limit:

$$\lim_{x\to 5} \frac{-3x^2+17x-10}{x-5} = \lim_{x\to 5} \frac{\_\_\_}{\_\_\_} = \_\_\_.$$

Quiz 5.1 – Exponential Growth and Decay

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/quiz-/comparison2pet.pg
A community had an initial population of 7000 people in 1990.

(a) First assume that the population decreased by a constant 75 people per year. Write a formula $P(t)$ that gives the population t years after 1990.

$P(t) =$ ________

(b) Now assume that the population decreased by a constant 9% per year. Write a formula $P(t)$ that gives the population t years after 1990.

$P(t) =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/quiz/interest1pet.pg
What is the balance after 1 year in an account containing $800 that earns a yearly nominal interest of 8% and is compounded

(a) annually? (once per year) $ ________
(b) weekly? (52 times per year) $ ________
(c) every minute? (525,600 times per year) $ ________
(d) continuously? $ ________

(Enter final answers only, not formulas. Round all answers to the nearest cent. Do not enter large numbers with commas.)

Quiz 5.2 – Derivative and Antiderivative of e^x

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/quiz/question1pet.pg

(a) If $f(t) = e^{3t}$, then $f'(t) =$ ______________.

(b) If $g(x) = 3e^{-9x}$, then $g'(x) =$ ______________.

(c) If $h(u) = -7e^{4u^3}$, then $h'(u) =$ ______________.

(d) If $F(x) = e^{3x^2+4x}$, then $F'(x) =$ ______________.

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/quiz/question2pet.pg

Evaluate each indefinite integral:

(a) $\int 6e^{2t}\,dt =$ ______________.

(b) $\int 2e^{-2t}\,dt =$ ______________.

(c) $\int -5e^{6t}\,dt =$ ______________.

(d) $\int 6e^{-t}\,dt =$ ______________.

Quiz 5.3 – Implicit Differentiation and Inverse Functions

1. **(1 pt) alfredLibrary/AUCI/chapter5/lesson3/quiz/implicit21pet.pg**
Compute the derivative of y for each equation.

(a) If $y = 4x^3$, then $\frac{dy}{dx} =$ __________.

(b) If $x^2 + y^3 = 40$, then $\frac{dy}{dx} =$ __________.

(c) If $xy^2 = 28$, then $\frac{dy}{dx} =$ __________.

2. **(1 pt) alfredLibrary/AUCI/chapter5/lesson3/quiz-/inversetable1pet.pg**

If the function $g(x)$ is defined by the table

x	-6	-4	-2	0	2	4	6
$g(x)$	0	-2	2	6	4	-4	-6

then the inverse function $g^{-1}(x)$ is defined by the table

x	-6	-4	-2	0	2	4	6
$g^{-1}(x)$	___	___	___	___	___	___	___

3. **(1 pt) alfredLibrary/AUCI/chapter5/lesson3/quiz-/inversesolve1pet.pg**
The inverse of the function $f(x) = 4x - 5$ is $f^{-1}(x) =$ __________.

Quiz 5.4 – Logarithmic Functions

1. **(1 pt) alfredLibrary/AUCI/chapter5/lesson4/quiz-/solveexponential1pet.pg**

(a) Find the EXACT solution to the exponential equation $800 = 20(1.1)^{4x}$. (*Do not give a decimal approximation.*)

$x =$ ____________

(b) Find the EXACT solution to the exponential equation $0.009e^{-1.27x} = 0.001$. (*Do not give a decimal approximation.*)

$x =$ ________________

(NOTE: WebWorK accepts 'ln' for the natural logarithm and 'log' for the base-10 logarithm.)

2. **(1 pt) alfredLibrary/AUCI/chapter5/lesson4/quiz-/solvelogarithm1pet.pg**

(a) Find the EXACT solution to $2\ln(3x+2) = 26$. *(Do not give a decimal approximation.)*

$x =$ ________________

(b) Find the EXACT solution to $6\log_{10}(x) = 10$. *(Do not give a decimal approximation.)*

$x =$ ________________

3. **(1 pt) alfredLibrary/AUCI/chapter5/lesson4/quiz/changebase1pet.pg**

(a) Evaluate the expression, correct to six decimal places, using the Change of Base Formula and the "ln" key on a calculator.

$\log_2 4 = \frac{\_\_\_}{\_\_\_} = \_\_\_$

(b) Evaluate the expression, correct to six decimal places, using the Change of Base Formula and the "log" (base 10) key on a calculator.

$\log_7 7 = \frac{\_\_\_}{\_\_\_} = \_\_\_$

(NOTE: WebWorK accepts 'ln' for the natural logarithm and 'log' for the base-10 logarithm.)

Quiz 5.5 – Derivatives and Antiderivatives of Exponentials and Logarithms

1. **(1 pt) alfredLibrary/AUCI/chapter5/lesson5/quiz/logderivs1pet.pg**

Practice differentiating logarithmic functions:

(a) If $y = \ln(x)$, then $y' =$ ______________.

(b) If $g(x) = \log_3(x)$, then $g'(x) =$ ______________.

(c) If $f(x) = \ln(x^2 - 10)$, then $f'(x) =$ ______________.

2. **(1 pt) alfredLibrary/AUCI/chapter5/lesson5/quiz/expderivs1pet.pg**

Practice differentiating exponential functions:

(a) If $y = e^x$, then $\frac{dy}{dx} =$ ________.

(b) If $y = 8^x$, then $\frac{dy}{dx} =$ ________.

(c) If $y = 1000 \cdot 1.03^x$, then $\frac{dy}{dx} =$ ________.

(d) If $y = e^{3x^2}$, then $\frac{dy}{dx} =$ __________.

(e) If $y = 4^{3x^2}$, then $\frac{dy}{dx} =$ __________.

3. **(1 pt) alfredLibrary/AUCI/chapter5/lesson5/quiz-/expintegrals1pet.pg**

Practice integrating exponential functions:

(a) $\int e^x dx =$ __________

(b) $\int 6^x dx =$ __________

(c) $\int 3 \cdot 4^x dx =$ __________

4. **(1 pt) alfredLibrary/AUCI/chapter5/lesson5/quiz/problem33pet.pg**

$\int \left(7 + \frac{4}{T} + \frac{10}{T^2}\right) dT =$ __________

Quiz 5.6 – Definite Integrals of Exponentials and Logarithms

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson6/quiz/riemann10pet.pg

We want to use left-hand, right-hand, and midpoint approximations with $n = 4$ subintervals of equal width to estimate $\int_{2.25}^{6.25} e^{1.5x}\,dx$.

(a) The width of each subinterval is $\Delta x =$ _____.

(b) If we use a left-hand approximation, then the left-hand endpoints are ____________ (as a comma-separated list).

The left-hand approximation is

$L_4 = \big($
___
$+$ ___
$+$ ___
$+$ ___
$\big)$ ___
$=$ ____________________

(c) If we use a right-hand approximation, then the right-hand endpoints are ____________ (as a comma-separated list).

The right-hand approximation is

$R_4 = \big($
___
$+$ ___
$+$ ___
$+$ ___
$\big)$ ___
$=$ ____________________

(d) If we use a midpoint approximation, then the midpoints are ____________ (as a comma-separated list).

The midpoint approximation is

$M_4 = \big($
___
$+$ ___
$+$ ___
$+$ ___
$\big)$ ___
$=$ ____________________

(e) Use the Fundamental Theorem to find the exact area and compare your answer to the approximations that you found above.

$\int_{2.25}^{6.25} e^{1.5x}\,dx =$ ____________

Quiz 6.1 – The Cosine and Sine Functions

1. (1 pt) alfredLibrary/AUCI/chapter6/lesson1/quiz/genform1pet.pg
Suppose $y = 4\pi\cos(-6t+4) - 3$. In your answers, enter 'pi' for π.

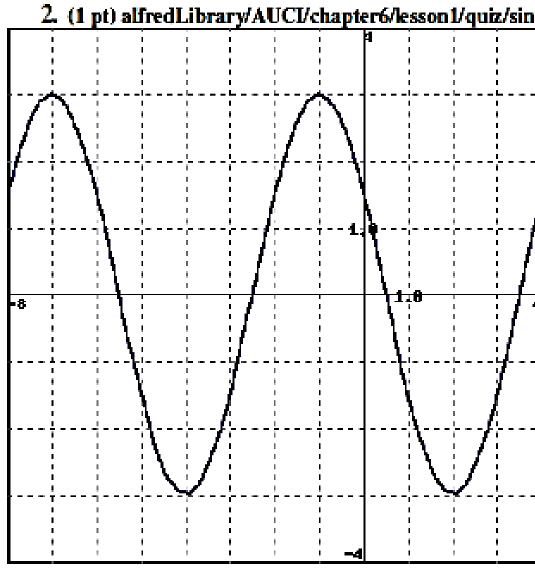
(a) The amplitude of the graph is ____.

(b) The period of the graph is ____.

(c) The phase (horizontal shift) of the graph is ____.

(d) The midline (vertical shift) of the graph is $y =$ ____.

2. (1 pt) alfredLibrary/AUCI/chapter6/lesson1/quiz/sinusoidal1pet.pg



(Click on the graph to get a better look.)

The curve above is the graph of a sinusoidal function f that passes through the points $(-4,-3)$ and $(2,-3)$. Find a sinusoidal equation for f of the form $f(x) = A\cos(Bx - C) + D$. If needed, you can enter π as 'pi' in your answer, otherwise use at least 3 decimal digits.

$f(x) =$ ______________________

Quiz 6.2 – Derivatives and Antiderivatives of Cosine and Sine

1. **(1 pt) alfredLibrary/AUCI/chapter6/lesson2/quiz/trigderiv11pet.pg**
Complete the derivative and integral formulas. Assume that x is measured in radians.

(a) $\frac{d}{dx}(\sin(x)) =$ _____

(b) $\frac{d}{dx}(\cos(x)) =$ _____

(c) $\int \sin(x)\,dx =$ _____

(d) $\int \cos(x)\,dx =$ _____

2. **(1 pt) alfredLibrary/AUCI/chapter6/lesson2/quiz/trigderiv22pet.pg**

(a) If $y = \frac{3+\sin x}{x+\cos x}$, then $y' =$ ______________.

(b) If $y = e^{\cos(9x)}$, then $y' =$ ______________.

3. **(1 pt) alfredLibrary/AUCI/chapter6/lesson2/quiz/trigderiv33pet.pg**
Evaluate each integral. Assume that x and t are measured in radians.

(a) $\int \cos(3.25x)\,dx =$ ______________

(b) $\int_0^{\pi/4} \sin(4t)dt =$ ______________

Quiz 6.3 – Other Trigonometric Functions

1. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/quiz/question2.pg
Suppose x is measured in radians. Find the derivative of each of the six trigonometric functions. You should memorize these formulas.

$(\tan(x))' =$ ________

$(\sin(x))' =$ ________

$(\cot(x))' =$ ________

$(\cos(x))' =$ ________

$(\sec(x))' =$ ________

$(\csc(x))' =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/quiz/question3pet.pg
Suppose x is measured in radians. Find the family of antiderivatives of each of the following functions. You should memorize these formulas.

$\int \cos(x)dx =$ ________

$\int \csc(x)\cot(x)dx =$ ________

$\int \sec(x)\tan(x)dx =$ ________

$\int \csc^2(x)dx =$ ________

$\int \sin(x)dx =$ ________

$\int \sec^2(x)dx =$ ________

3. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/quiz/trigintegral5pet.pg
Evaluate the integral. (HINT: The integrand is a composition in which the inside is linear.)

$\int \sec^2(8x-3)dx =$ ________________.

Quiz 6.4 – Other Trigonometric Functions

---

1. (1 point) —alfredLibrary/AUCI/chapter6/lesson4/quiz/question2.pg—
Suppose x is measured in radians. Find the derivative of each inverse trigonometric function. You should memorize these formulas.

$(\sin^{-1}(x))' =$ ________

$(\cos^{-1}(x))' =$ ________

$(\tan^{-1}(x))' =$ ________

---

2. (1 point) —alfredLibrary/AUCI/chapter6/lesson4/quiz/question3.pg—
Evaluate each indefinite integral. You should memorize these formulas.

$\int \frac{1}{\sqrt{1-x^2}} dx =$ ________

$\int \frac{1}{1+x^2} dx =$ ________

$\int \frac{-1}{\sqrt{1-x^2}} dx =$ ________

---

3. (1 point) —alfredLibrary/AUCI/chapter6/lesson4/quiz/invtrigderiv1p
(a) If $y = \arccos(e^{5x})$,

then $\frac{dy}{dx} =$ ____________.

(b) If $f(x) = x^3 \tan^{-1}(6x)$,

then $f'(x) =$ ____________.

Quiz 7.1 – Related Rates

1. (1 point) —alfredLibrary/AUCI/chapter7/lesson1/quiz/Leibnizpet1jsmath.pg—
For this problem, time is given by the variable t, position by s, area by A, and volume by V. Numerical answers require **units**.

Translate the following sentences into Leibniz notation:

(a) The position of an object is increasing at a rate of 15 meters per second.

______________ = ___

(b) The area of an object is increasing by 35 square meters every minute.

______________ = ___

(c) The volume of an object is decreasing by 34 cubic meters for every square meter increase in area.

______________ = ___

2. (1 point) —alfredLibrary/AUCI/chapter7/lesson1/quiz/relatedrates1pet.pg—
A 16-ft ladder is leaning against a wall, and the top of the ladder is sliding down the wall at a constant rate of 1.75 ft/s. How fast is the bottom of the ladder sliding away from the wall when the top of the ladder is 4 ft above the ground?

Solution:
Let x be the distance from the bottom of the ladder to the wall, and let y be the distance from the top of the ladder to the ground. Draw a labeled sketch!

The related variables equation is

Related Variables Equation: __________ = 256

Implicitly differentiate both sides of the related variables equation with respect to t, using x' for $\frac{dx}{dt}$ and y' for $\frac{dy}{dt}$. Without simplifying further, the related rates equation is

Related Rates Equation: __________ = ___

BEFORE plugging in the given information, solve the Related Rates Equation for x' to get a formula for the rate at which the bottom of the ladder is sliding away from the wall:

$$x' = \frac{dx}{dt} = \_\_\_\_\_\_\_\_\_\_$$

Finally, when the top of the ladder is 4 ft above the ground, the rate at which the bottom of the ladder is sliding away from the wall is

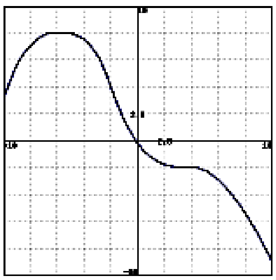
$\frac{dx}{dt}$ = __________ ft/s

3. (1 point) —alfredLibrary/AUCI/chapter7/lesson1/quiz/relatedrates11
The volume of an inflating spherical balloon is increasing by $\frac{dV}{dt} = 7028\ \frac{\text{in}^3}{\text{min}}$. How fast is the radius increasing when the radius is $r = 16$ in? Recall, the volume V of a sphere of radius r is $V = \frac{4}{3}\pi r^3$.

Answer: ______________ (Your answer requires units. **units**.)

Quiz 7.2 – Graph Analysis Using First and Second Derivatives

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson2/quiz-/graphanalysis2pet.pg



The graph of the function f is shown above. Set up number lines and signs for f, f', and f'', and interpret them in terms of extrema (l. max, l. min), inflection (infl), increase/decrease/constant (inc, dec, const), and concavity (cu, cd). Choose the answers in the table that match your conclusions.

		$x<-6$	$x=-6$	$-6<x<-2$	$x=-2$	$-2<x<4$	$x=4$	$x>4$
f		?	?	?	?	?	?	?
		?		?		?		?
f'		?	?	?	?	?	?	?
		?		?		?		?
f''		?	?	?	?	?	?	?

(a) Compute the first and second derivatives of f, set up number lines for each, and perform sign tests.

(b) List all critical numbers of f. If there are no critical values, enter 'NONE'.
Critical numbers = ________

(c) Use interval notation to indicate where f is increasing.
Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.
Increasing: ________

(d) Use interval notation to indicate where f is decreasing.
Decreasing: ________

(e) List the x-coordinates of all local maxima of f. If there are no local maxima, enter 'NONE'.
x values of local maxima = ________

(f) List the x-coordinates of all local minima of f. If there are no local minima, enter 'NONE'.
x values of local minima = ________

(g) Use interval notation to indicate where f is concave up.
Concave up: ________

(h) Use interval notation to indicate where f is concave down.
Concave down: ________

(i) List the x values of all inflection points of f. If there are no inflection points, enter 'NONE'.
x values of inflection points = ________

(j) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.
Graph Complete: ______

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson2/graphanalysis4pet.pg

Suppose that

$$f(x)=\ln(7x^2+5).$$

Quiz 7.3 – Graph Analysis with the TI-84

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/quiz/values1pet.pg
Consider the function f defined by

$$f(x) = \frac{x^2+3}{x-5}$$

Graph f on your graphing calculator for x in the interval $[0,5]$ (note the asymptote at $x=5$). Use the options in the "calculate" menu to find the following function values. Round your answers to at least four decimal places.

$f(0.75) =$ _____

$f(3.63) =$ _____

$f(0.39) =$ _____

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/quiz/zeros1pet.pg
Use your graphing calculator and the options in the "calculate" menu to approximate the solutions to the equation.

$$x^3 + 0.9x^2 + 0.9x - 0.1 = 0.$$

In other words, find the x-intercepts of the function

$$y = x^3 + 0.9x^2 + 0.9x - 0.1.$$

If there is more than one solution, then enter them as a comma-separated list.

$x =$ ________________

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/quiz/derivative1pet.pg
Suppose

$$f(x) = \frac{x^8(x-2)^7}{(x^2+1)^3}$$

Use your graphing calculator and the options in the "calculate" menu to find the derivative of f at $x=1$.

$f'(1) =$ ____________________

Quiz 7.4 – The Extreme Value Theorem and Optimization

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/quiz/EVTTF1pet.pg
In each case, decide whether the function satisfies the hypothesis of the Extreme Value Theorem on the given interval. (Hint: The hypothesis of the EVT contains two conditions.)

Notice that you only have a limited number of attempts.

? 1. $f(x) = \frac{1}{x}$ on $(0,3)$
? 2. $f(x) = x^2$ on $[-2,3]$
? 3. $f(x) = \frac{1}{x}$ on $(\frac{1}{2},3)$
? 4. $f(x) = \sin^{-1}(x)$ on $[\frac{-1}{2},\frac{1}{2}]$
? 5. $f(x) = x^2$ on $(-2,3)$
? 6. $f(x) = \frac{1}{x}$ on $[\frac{-1}{2},3]$
? 7. $f(x) = \frac{1}{x}$ on $[\frac{1}{2},3]$

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/quiz/EVT1pet.pg
Let $f(x) = 2x^3 - 33x^2 + (-156)x$. Complete this problem without a graphing calculator.

(a) The derivative of $f(x)$ is $f'(x) =$ ________.

(b) As a comma-separated list, the critical points of f are $x =$ ________.

Since f is continuous on the closed interval $[-3,21]$, f has both an absolute maximum and an absolute minimum on the interval $[-3,21]$ according to the Extreme Value Theorem. To find the extreme values, we evaluate f at the endpoints and at the critical points.

(c) As a comma-separated list, the y-values corresponding to the critical points and endpoints are $y =$ ________.

(d) The minimum value of f on $[-3,21]$ is $y =$ ________,
the minimum value occurs at $x =$ ________,
and this x is a(n) ?.

(e) The maximum value of f on $[-3,21]$ is $y =$ ________,
the maximum value occurs at $x =$ ________,
and this x is a(n) ?.

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/quiz-/optimization1pet.pg
A cylindrical can **without a top** must be constructed to contain $V = 2500 cm^3$ of liquid. Find the base radius r and height h that will minimize the amount of material needed to construct the can.

Base radius $r =$ ________ cm
Height $h =$ ________ cm

Quiz 7.5 – Differential Equations

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/quiz/question5pet.pg
Find y as a function of t if $10000y'' - 729y = 0$, $y(0) = 1$, and $y'(0) = 2$.

$y(t) =$ ______________________

(HINT: First solve $10000y'' - 729y = 0$ for y''.)

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/quiz/DE2pet.pg
Find y as a function of t given that $1600y'' + 729y = 0$, $y(0) = 8$, and $y'(0) = 7$.

$y(t) =$ __________________

(HINT: First solve $1600y'' + 729y = 0$ for y''.)

Quiz 8.1 – Sigma Notation and Summations

1. **(1 pt) alfredLibrary/AUCI/chapter8/lesson1/quiz/sum1pet.pg**
Use the "summation formulas" to find the numerical value of each sum.

(a) $\sum_{k=1}^{110} k =$ ______________

(b) $\sum_{k=1}^{130} 25 =$ ______________

(c) $\sum_{k=1}^{120} (7k+3) =$ ______________

(d) $\sum_{k=1}^{65} k^2 =$ ______________

2. **(1 pt) alfredLibrary/AUCI/chapter8/lesson1/quiz-/summationformula1pet.pg**

"Peel off" as many terms as necessary so that the appropriate summation formula can be used.

$\sum_{k=-2}^{43} k^3 =$ ___ + ___ + ___ + ___∑k=1 ___

$=$ ___ $+$ $(\_\_)^2 (\_\_)^2$ ______________

$=$ ______________

3. **(1 pt) alfredLibrary/AUCI/chapter8/lesson1/quiz/sum7pet.pg**
Use the "summation formulas" to express the following sum in closed form. Your answer should be in terms of n.

$\sum_{k=1}^{n} (4+4k)^2 =$ ______________

(HINT: You must first expand $(4+4k)^2$).

Quiz 8.2 – The Definition of Net Area

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson2/quiz-/rightriemannsum12pet.pg

To compute $\int_a^b f(x)dx$ using a Riemann sum and the definition of the definite integral, we first divide the interval $[a,b]$ into n subintervals of equal width Δx. Then we choose any point x_k^* in the k^{th} subinterval $[x_{k-1}, x_k]$. Common choices include left-hand endpoints, midpoints, and right-hand endpoints:

LH $: x_k^* = a + (k-1)\Delta x$
Mid $: x_k^* = a + (k - \frac{1}{2})\Delta x$
RH $: x_k^* = a + k\Delta x$

We will use a right hand Riemann sum to compute $\int_{-8}^{-7.5} 18x^2 dx$.

(a) For n subintervals, the width of each subinterval is

$\Delta x =$ ________.

(b) If we substitute the lower limit a and Δx into the formula for right-hand endpoints given above, we obtain

$x_k^* =$ ________ for $k = 1, 2, 3, \ldots, n$.

(c) The height of the k^{th} rectangle is

$f(x_k^*) =$ ________

(d) The area of the k^{th} rectangle is (as powers of k)

$f(x_k^*)\Delta x =$ ________

$=$ ______ $+$ ______ $k+$ ______ k^2

(e) The right hand Riemann sum is given by

$$R_n = \sum_{k=1}^{n} f(x_k^*)\Delta x$$

$= $ ________ $\sum_{k=1}^{n} 1 +$ ________ $\sum_{k=1}^{n} k +$ ________ $\sum_{k=1}^{n} k^2$

$=$ ________ $+$ ________ $+$ ________

(f) Finally,

$\int_{-8}^{-7.5} 18x^2 dx = \lim_{n\to\infty} \sum_{k=1}^{n} f(x_k^*)\Delta x =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson2/quiz/defintegral1pet.pg

Use the properties of the definite integral to evaluate $\int_0^{16} |x - 8| dx$.

Answer: ____________

Quiz 8.3 – Rolle's Theorem and the Mean Value Theorem

1. **(1 pt) alfredLibrary/AUCI/chapter8/lesson3/quiz/Rolles1pet.pg**
Consider the function $f(x) = x^2 - 4x$ on the interval $[0,4]$. Verify that this function satisfies the three hypotheses of Rolle's Theorem on the inverval:

$f(x)$ is $\boxed{?}$ on $[0,4]$;

$f(x)$ is $\boxed{?}$ on $(0,4)$;

and $f(0) = f(4) =$ __________.

Therefore, by Rolle's theorem, there exists a c in $(0,4)$ such that $f'(c) = 0$. Find c.

$c =$ _____

2. **(1 pt) alfredLibrary/AUCI/chapter8/lesson3/MVT22pet.pg**
Find all numbers c that satisfy the conclusion of the Mean Value Theorem for the function $f(x) = x^2 - 2x - 15$ on the interval $[-5,6]$.

If there are multiple values, separate them with commas; enter N if there are no such values.

$c =$ ____________________

Quiz 8.4 – The Fundamental Theorem of Calculus (Part 1)

1. **(1 pt) alfredLibrary/AUCI/chapter8/lesson4/quiz/FTC1pet.pg**
Use Part 1 of the Fundamental Theorem of Calculus to evaluate the definite integral.

$$\int_3^9 \frac{6}{\sqrt{x}} dx = \underline{\hspace{4cm}}$$

2. **(1 pt) alfredLibrary/AUCI/chapter8/lesson4/quiz/FTC3pet.pg**
Use Part 1 of the Fundamental Theorem of Calculus to evaluate the definite integral.

$$\int_{0.8}^1 6\sec^2(x)\, dx = \underline{\hspace{4cm}}$$

3. **(1 pt) alfredLibrary/AUCI/chapter8/lesson4/quiz/FTC5pet.pg**
Use Part 1 of the Fundamental Theorem of Calculus to evaluate the definite integral.

$$\int_3^4 -\frac{3}{x^5}\, dx = \underline{\hspace{4cm}}$$

Quiz 8.5 – The Fundamental Theorem of Calculus (Part 2)

1. **(1 pt) alfredLibrary/AUCI/chapter8/lesson5/quiz/FTC1pet.pg**

If $f(x) = \int_0^x (t^3 + 3t^2 + 5)\, dt$,

then $f'(x) =$ ________,

and $f''(x) =$ ________.

2. **(1 pt) alfredLibrary/AUCI/chapter8/lesson5/quiz/FTC2pet.pg**

If $f(x) = \int_x^5 t^3 \cos(t)\, dt$,

then $f'(x) =$ ________.

3. **(1 pt) alfredLibrary/AUCI/chapter8/lesson5/quiz/FTC3pet.pg**

If $f(x) = \int_0^{x^2} \frac{t^2 - 4}{\sin t}\, dt$,

then $f'(x) =$ ____________.

Quiz 8.6 – Integration by Substitution

1. (1 point) —alfredLibrary/AUCI/chapter8/lesson6/quiz/indefiniteusub3pet.pg—
For the indefinite integral $\int x^2\sqrt{9+x^3}dx$, a good choice for a u -substitution is

$u =$ ________

$du =$ ________ (be sure to include dx)

Now make the substitution into the given integral to get an integral in terms of u only, and its antiderivative in terms of u only:

$\int$ ________ $=$ ________.

Therefore, the given integral in terms of x is $\int x^2\sqrt{9+x^3}dx =$________.

2. (1 point) —alfredLibrary/AUCI/chapter8/lesson6/quiz/definiteusub21.
Evaluate the definite integral using an appropriate u-substitution.

$\int_0^{\sqrt{\pi}} x\cos(x^2)\,dx =$ ________

Quiz 8.7 – Modeling Accumulated Change with the TI-84

1. **(1 pt) alfredLibrary/AUCI/chapter8/lesson7/quiz/definiteint.pg**
Use your calculator to evaluate the integral.

$\int_1^2 \sqrt{t}\ln t\,dt =$ __________

2. **(1 pt) alfredLibrary/AUCI/chapter8/lesson7/quiz/rect1pet.pg**
Suppose an object is moving along a line with velocity $v(t) = t^2 - 4t + 3$ miles per hour.

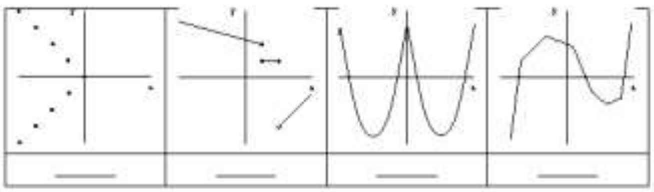
Use your calculator to find the displacement and the total distance traveled by the object during the time interval $[0, 8]$.

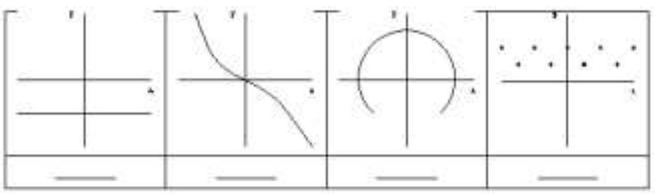
Displacement = _______ miles

Total distance traveled = _______ miles

Homework 1.1 – Average Rates of Change

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson1/function.pg
Decide whether each of the following 8 graphs represent y as a function of x. If so, type 'yes' under the graph. If not, type 'no' under the graph. Click on the graph to enlarge the image.





2. (1 pt) alfredLibrary/AUCI/chapter1/lesson1/question10p.pg

The graph of $y = f(x)$ is given in the figure.

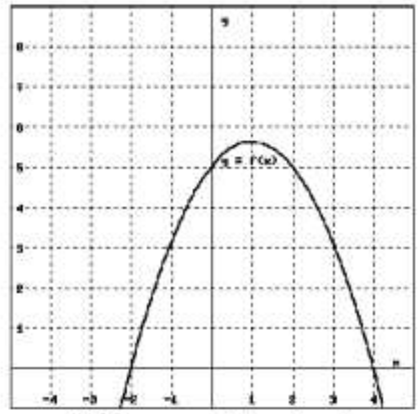
(a) The y-intercept of the graph is the y-coordinate at which the graph touches or crosses the y-axis. It can be found by substituting $x = 0$ into the formula to get $f(0)$. Visually determine the y-intercept.

$f(0) =$ ______

(b) The x-intercepts of the graph are the x-coordinates at which the graph touches or crosses the x-axis. Visually determine the x-intercept(s). If there is more than one, enter them as a comma-separated list.

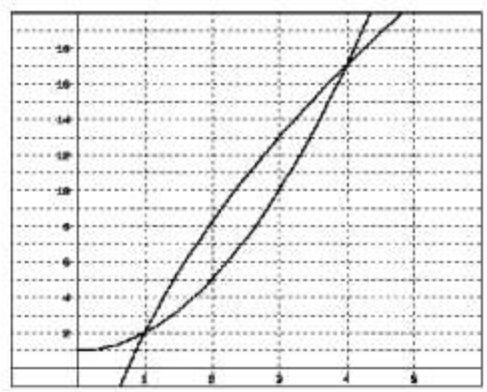
$x =$ ______

(c) A function is positive (greater than zero) on an open interval if the graph lies above the x-axis on that interval. On which interval is $f(x) > 0$?



(Click on graph to enlarge)

3. (1 pt) alfredLibrary/AUCI/chapter1/lesson1/quiz/question2.pg



(Click on the graph to get a larger version.)

On the interval [1,4], the average rate of change of the red function is [?] the average rate of change of the blue function.

This problem demonstrates that the average rate of change of a function on an interval does not describe the behavior of the function within the interval.

4. (1 pt) alfredLibrary/AUCI/chapter1/lesson1/question49p.pg
According to the 1993 World Almanac, the number of calories a person walking at 3 mph, bicycling at 10 mph, or swimming at 2 mph burns per minute depends on the person's weight as in the following table.

Calories per minute as a function of weight

Weight (pounds)	100	120	150	170	200	220
Walking (calories)	2.7	3.2	4.0	4.6	5.4	5.9
Bicycling (calories)	5.4	6.5	8.1	9.2	10.8	11.9
Swimming (calories)	5.8	6.9	8.7	9.8	11.6	12.7

(a) Use the table to determine the number of calories that a person weighing 220 pounds uses in a half-hour of walking.

____

(b) The table illustrates a relationship between the number of calories used per minute walking and a person's weight in pounds.

Identify the independent variable(s)

- A. calories used per minute bicycling
- B. weight in pounds
- C. calories used per minute walking
- D. calories used per minute swimming

Identify the dependent variable(s)

- A. calories used per minute walking
- B. weight in pounds
- C. calories used per minute bicycling
- D. calories used per minute swimming

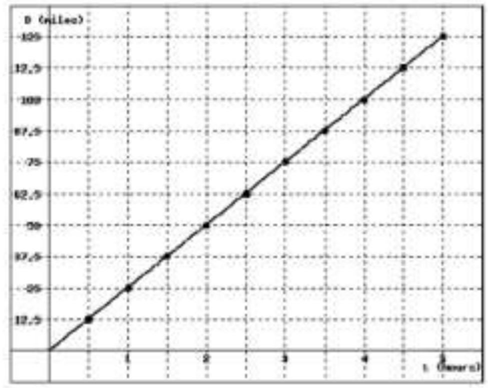
The function described in this relationship is

- A. increasing (getting larger)
- B. decreasing (getting smaller)
- C. constant (staying the same)

---

5. **(1 pt) alfredLibrary/AUCI/chapter1/lesson1/question1p.pg**

The graph below shows the distance traveled, D (in miles) as a function of time, t (in hours).



(Click on the graph to get a larger version.)

(a) For each of the intervals, find the values of ΔD and Δt between the indicated start and end times. Enter your answers in their respective columns in the table below.

Time Interval	ΔD	Δt
$t = 1$ to $t = 3$	____	____
$t = 1.5$ to $t = 3$	____	____
$t = 0.5$ to $t = 3.5$	____	____

(b) Based on your results from (a) it follows that the average rate of change of D is constant, and it does not depend over which interval of time you choose. What is the constant rate of change of D ?

$\frac{\Delta D}{\Delta t} =$ ________

Notice that the graph of D is a line and that the average rate of change of D is constant. The average rate of change of a line is used to measure its steepness, or *slope* .

(c) Which of the statements below CORRECTLY explains the significance of your answer to part (b)? Select ALL that apply (more than one may apply).

- A. It is the acceleration of the car over the five hour time interval.
- B. It is the slope of the line.
- C. It is the average velocity of the car over the first two hours.
- D. It is how far the car will travel in a half-hour.
- E. It represents the car's velocity.
- F. It is the total distance the car travels in five hours.
- G. None of the above

Homework 1.2 – Linear Functions

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/question22.pg

Suppose $f(x) = 2x + 1$.

(a) Find the y-intercept of f by evaluating $f(0)$:

$y = f(0) =$ __________

(b) Find the x-intercept(s) of f by solving $f(x) = 0$ for x:

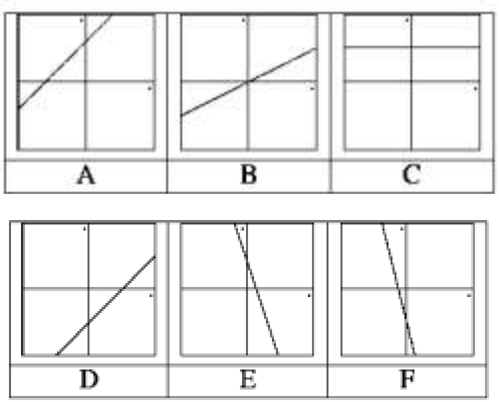
$x =$ __________

2. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/question2p.pg

Consider the set of equations below:

_____	$y = x + 6$
_____	$y = x - 5$
_____	$5 = y$
_____	$y = x/2$
_____	$y = -4x - 5$
_____	$-3x + 4 = y$

Without using a calculator, match each equation with one of the graphs by entering the letter of the correct graph in the blank.



3. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/question7p.pg

Write $7x - 11y + 16 = 0$ in slope-intercept form.

(a) The slope of the line is __________.

(b) The y- intercept of the line is __________.

4. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/question13p.pg

The table below contains data for a linear function:

t	7.2	7.4	7.6	7.8
$f(t)$	565.8	576.6	587.4	598.2

A formula for the function is $f(t) =$ ______________.

HINT: First find the point-slope form of the line.

5. (1 pt) alfredLibrary/AUCI/chapter1/lesson2/question4p.pg

The amount of money (in dollars) charged a phone company is

$$C(n) = 27.75 + 0.13n,$$

where n is the number of minutes used.

(a) Which of the following statements correctly explains the significance of the y -intercept in the equation above?

- A. If you do not use your phone all month, your monthly phone bill will be \$0.13 .
- B. For every minute you talk on the phone your monthly phone bill increases by \$27.75 .
- C. The phone company charges \$0.13 per minute to use the phone.
- D. The fixed monthly service charge is \$27.75 .
- E. All of the above
- F. None of the above

(b) Which of the following statements correctly explains the significance of the slope in the equation above?

- A. If you do not use your phone all month, your monthly phone bill will be \$0.13 .
- B. The fixed monthly service charge is \$27.75 .
- C. The phone company charges \$0.13 per minute to use the phone.
- D. For every minute you talk on the phone your monthly phone bill increases by \$27.75 .
- E. All of the above
- F. None of the above

Homework 1.3 – Derivatives of Linear Functions

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson3/derivativeoflinear1.pg
Suppose b is a real constant.

If $f(x) = b$, then $f'(x) =$ ________.

If $g(x) = 17$, then $g'(x) =$ ________.

If $h(x) = -5$, then $h'(x) =$ ________.

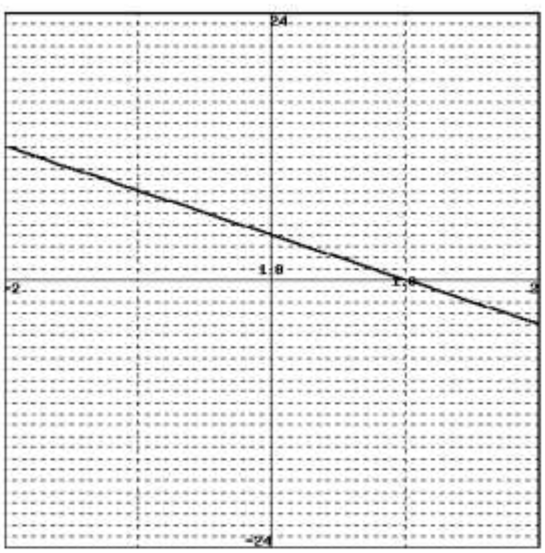
2. (1 pt) alfredLibrary/AUCI/chapter1/lesson3/derivativeoflinear2.pg
Suppose m and b are real constants.

If $f(x) = mx + b$, then $f'(x) =$ _____.

If $g(x) = 5x - 8$, then $g'(x) =$ __________.

If $h(x) = -15x + 26$, then $h'(x) =$ __________.

3. (1 pt) alfredLibrary/AUCI/chapter1/lesson3/derivativefromgraph2pet.pg
Suppose the position s of a car at time t is linear as shown in the graph below. Your answers must include **units**.



If the position is given in feet and time is measured in minutes, then $s'(t) =$ ________.

This means that the velocity (rate of change of position) of the car is ________.

4. (1 pt) alfredLibrary/AUCI/chapter1/lesson3/derivativeasslope1pet.pg
The function $H(t)$ measures the amount of hydrogen in a tank, in cubic feet, at time t hours. Suppose $H(t)$ is a linear function such that $H(3) = 114 ft^3$, and $H'(3) = 3\frac{ft^3}{hr}$. Then

$H(11) =$ ________ (Include **units**.)

Hint: First find the point-slope form for H.

5. (1 pt) alfredLibrary/AUCI/chapter1/lesson3/quiz/question3p.pg
Suppose $b(t)$ is the length of a bamboo shoot, measured in kilometers, at time t, measured in days. Then $b'(t)$ represents the rate at which the length is changing at time t, and $b''(t)$ is the rate at which the rate of change is changing at time t.

The units for $b'(t)$ are ________.

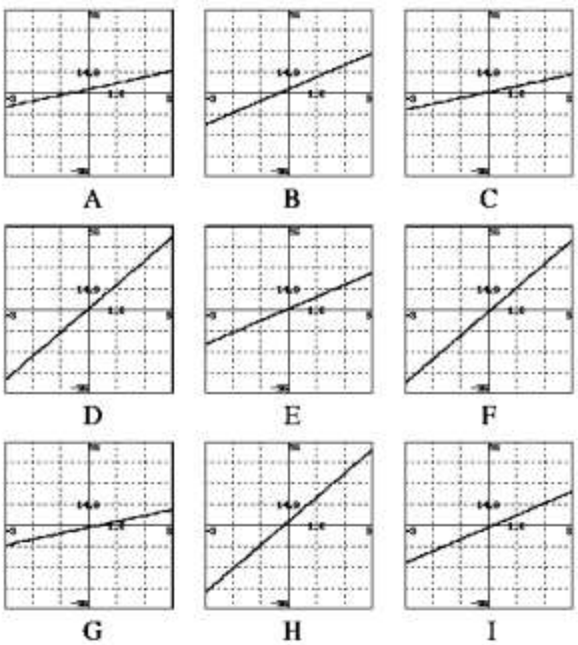
The units for $b''(t)$ are ________.

Abbreviations for **units**.

Homework 1.4 – Integrals of Constant Functions

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson4/findantiderivatives1pet.pg
Check the box if the corresponding graph shows a function y that satisfies the condition $y' = 8$. There may be more than one correct answer.

- A. A
- B. B
- C. C
- D. D
- E. E
- F. F
- G. G
- H. H
- I. I



2. (1 pt) alfredLibrary/AUCI/chapter1/lesson4/quiz/question3p.pg
The indefinite integral of a constant function represents the family of antiderivatives. This is the set of all linear functions whose derivatives are the given constant function.

The definite integral of a constant function on an interval represents the net area bounded by the graph on the interval. It can be computed using the Fundamental Theorem of Calculus.

Evaluate each integral.

1. (a) $\int 4\,dx =$ __________

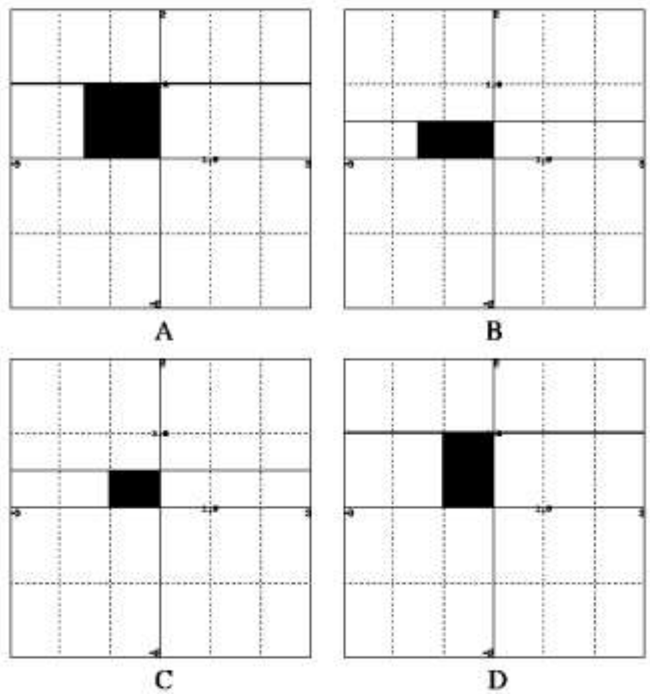
(b) $\int_{-9}^{-2} 4\,dx =$ __________

2. (a) $\int -4\,dx =$ __________

(b) $\int_{3}^{8} -4\,dx =$ __________

3. (1 pt) alfredLibrary/AUCI/chapter1/lesson5/matcharea2.pg
Which of the shaded regions corresponds to the expression $\int_{-1.5}^{0} 1\,dx$?

- A. A
- B. B
- C. C
- D. D



4. (1 pt) alfredLibrary/AUCI/chapter1/lesson5/fluid2.pg
(Include *units* *in each of your answers!)*

The height of water in a rectangular tank is given by $h(w)$, where w is the volume of water (in liters) that has been removed from the tank. The height of the water decreases 20mm per liter removed.

(a) From the time when 6 L have been removed to the time when 14 L have been removed, the accumulated change in the height of the water is

$$\underline{\quad}\int\underline{\quad}\ \underline{\quad\quad}\ \mathrm{dw} = \underline{\quad\quad\quad}$$

(b) If the initial height of the water is 600mm, then the height of the water after w liters have been removed is

$h(w) =$ ________.

Therefore,

$h(6\text{ L}) =$ ________, and

$h(14\text{ L}) =$ ________.

From the time when 6 L have been removed to the time when 14 L have been removed, the net change in height of the water is

$h(14\text{ L}) - h(6\text{ L}) =$ ________.

(c) Compare your final answers from parts (a) and (b). Are they the same or different? Why or why not?

---

5. (1 pt) alfredLibrary/AUCI/chapter1/lesson4/IVP2pet.pg

The family of antiderivatives of a constant function $y' = m$ is an infinite family of linear functions $y = mx + C$. If a point in the plane is given (e.g., the initial value), then exacly one member of the family passes through that point. This member of the family is identified by a unique value for C. An *initial value problem* is a problem in which we must use a given point to find a particular C. Here are two examples:

____ = ______

(a) If $f'(t) = 1$ then the most general formula for f is

$\int$ __ $dt =$ ________.

This answer represents a family of linear functions whose slopes are $m = 1$. Find the member of the family that passes through the point $(0,4)$. That is, if $f(0) = 4$, then

$f(t) =$ ________.

(b) If $g'(t) = 8$, then the most general formula for g is

$\int$ __ $dt =$ ________.

This answer represents a family of linear functions whose slopes are $m = 8$. Find the member of the family that passes through the point $(3,5)$. That is, if $g(3) = 5$, then

$g(t) =$ ________.

Homework 1.5 – Rectilinear Motion

1. (1 pt) alfredLibrary/AUCI/chapter1/lesson5/billsally1pet.pg
(Include **units** *in your answers!)*

For this problem east will be considered the positive direction.

Suppose Bill and Sally are returning from vacation traveling WESTWARD at a constant SPEED of 45 mi/hr. We will compute the displacement using two different methods.

(a) **METHOD 1: Area bounded by the velocity curve.**

From time 5 hr to time 7 hr, the displacement is given by

$$\_\int\_ \;\_\_\_\; dt = \;\_\_\_\_\_ \Big|\_\_\_ = \_\_\_\_$$

(b) **METHOD 2: Net change in position.**

If Bill and Sally started 1500 miles east of home, then their position function is

$s(t) =$ ________.

Therefore,

$s(5\text{ hr}) =$ ________ and $s(7\text{ hr}) =$ ________.

From time 5 hr to time 7 hr, the displacement is given by

$s(7\text{ hr}) - s(5\text{ hr}) =$ ________.

NOTE: Parts (a) and (b) yield the same answer according to the Fundamental Theorem.

2. (1 pt) alfredLibrary/AUCI/chapter1/lesson5/quiz-/speedanddistance30p.pg

(You do not need units for part (a), but you do need to include 'dt.')

(a) If an object travels along a line with constant velocity $-34\,\frac{\text{m}}{\text{s}}$, then the general formula for the position of the object is

$s(t) = \int$ ____ = ________.

(All of your answers from here on require **units***.)*

(b) If the object has an initial position of 498 m, then we can find the unknown constant C. In this case, the particular position function is

$s(t) =$ ________.

From this position function, we find that the object is at the origin at time $t =$ ____.

(c) The net change in the object's position (i.e., the displacement) from time 3.25 s to time 18.25 s is

$$s(\;\_\;) - s(\;\_\;) = \_\int\_ \;\_\_\_\; dt =$$

(d) The total distance traveled over the same time period is

$$\_\int\_ \;\_\_\_\; dt = \;\_\_\_\_\_ \Big|\_\_\_ = \_$$

(HINT: Integrate the speed.)

3. (1 pt) alfredLibrary/AUCI/chapter1/lesson5/quiz-/DisplAndTotalDist.pg
Suppose $v(t) = 4 - 2t$ is the velocity (in meters per second) of an object in rectilinear motion.

(a) Sketch the graph of v on the interval $[-1,3]$.

(b) The t-intercept of $v(t)$ is the time at which the velocity is zero. In this case, the t-intercept is

$t =$ __________ s.

(c) Use the graph of $v(t) = 4 - 2t$ and geometry to find the displacement of the object on $[-1,3]$.

$\int_{-1}^{3}(4-2t)\,dt =$ __________ m.

(d) Use the graph of $|v(t)| = |4-2t|$ and geometry to find the total distance traveled by the object on $[-1,3]$.

$\int_{-1}^{3} |4-2t|\,dt =$ ______________ m.

4. (1 pt) alfredLibrary/AUCI/chapter1/lesson5/reservoir1pet.pg

Let t be time in seconds and let $r(t)$ be the RATE (not the total amount), in gallons per second, at which water enters a reservoir:

$r(t) = 800 - 35t$ gal/s

(a) Evaluate the expression $r(5) =$ ______________

(b) Which one of the statements below best describes the physical meaning of the value of $r(5)$?

- A. The rate at which the rate of the water entering the reservoir is decreasing when 5 gallons remain in the reservoir.
- B. How many seconds until the water is entering to reservoir at a rate of 5 gallons per second.
- C. The rate, in gallons per second, at which the water is entering reservoir after 5 seconds.
- D. The total amount, in gallons, of water in the reservoir after 5 seconds.
- E. None of the above.

(c) For each of the following two mathematical expressions, match one of the statements A - E from the list below which best explains its meaning in practical terms.

___1. The horizontal intercept of the graph of $r(t)$.
___2. The vertical intercept of the graph of $r(t)$.

A. How many seconds it takes until there is no longer any water in the reservoir.
B. The rate at which the rate of water entering the reservoir is decreasing in gallons per second squared.
C. The initial amount of water, in gallons, in the reservoir.
D. After how many seconds the water stops flowing into the reservoir and starts to drain out.
E. The rate, in gallons per second, at which the water is initially entering the reservoir.

(d) For $0 \le t \le 40$, when does the reservoir have the most water? (Hint: The net area bounded by the rate graph represents the displacement in water on the given interval.)

When $t =$ _____ s

(e) For $0 \le t \le 40$, when does the reservoir have the least water? (Hint: The net area bounded by the rate graph represents displacement in water on the given interval.)

When $t =$ _____ s

(f) If the domain of $r(t)$ is $0 \le t \le 40$, what is the range of $r(t)$ over this domain?

______________ (help on using **interval notation**)

Homework 2.1 – Derivatives of Quadratic Functions

---

1. (1 pt) alfredLibrary/AUCI/chapter2/lesson1/quiz-/questionQuadp4.pg
The point $P=(5,36)$ lies on the curve $y=x^2+x+6$.

(a) For the given values of x, let Q be the nearby point (x,x^2+x+6). Find the slope of the secant line between P and Q. (Hint: $\frac{y(x)-y(5)}{x-5}$.)

If $x=5.1$, then the slope between P and Q is ____________

If $x=5.01$, then the slope between P and Q is ____________

If $x=4.9$, then the slope between P and Q is ____________

If $x=4.99$, then the slope between P and Q is ____________

(b) Based on the above results, guess the slope of the tangent line (derivative) at $P=(5,36)$.

$y'(5)=$ ____________

---

2. (1 pt) alfredLibrary/AUCI/chapter2/lesson1/Velocity2p.pg
If a ball is thrown straight up into the air with an initial velocity of 85 ft/s, its height in feet after t seconds is given by $h(t)=85t-16t^2$. Find the average velocity on the following time intervals:

$[2,2.1]$: ________________ ft/s

$[2,2.01]$: ________________ ft/s

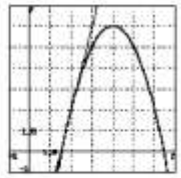
$[2,2.001]$: ________________ ft/s

Based on the above results, guess what the instantaneous velocity of the ball is when $t=2$.

$v(2)=$ __________ ft/s

---

3. (1 pt) alfredLibrary/AUCI/chapter2/lesson1/estimateslope1pet.pg
Use the graph of $y=f(x)$ in the accompanying figure to estimate the value of $f'(2)$.



Click on the image to see a larger graph.

An estimate of $f'(2)$ is __________

---

4. (1 pt) alfredLibrary/AUCI/chapter2/lesson1/growthrate2pet.pg
The population of a slowly growing bacterial colony after t hours is given by $p(t)=4t^2+34t+200$ bacteria. The growth rate after 2 hours is __________ bacteria per hour. (Use the formula for the derivative of a quadratic.)

---

5. (1 pt) alfredLibrary/AUCI/chapter2/lesson1/quadapplication3pet.pg
Suppose that the equation of motion for a particle is $s(t)=4t^2-2t+4$, where s is meters and t is seconds.

(a) Find the velocity and acceleration as functions of t. (Use the formulas for the derivatives of quadratic and linear functions.)

$v(t)=$ __________ m/s

$a(t)=$ __________ m/s^2

(b) Find the time at which the particle is at rest.

$t=$ __________ s

Homework 2.2 – Analyzing Quadratic Functions

1. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quiz/question11pet.pg—
Find all real number solutions to the difference of squares equation

$$x^2 - 1 = 0$$

Solutions (separate by commas): $x =$ ______________

2. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quad9p.pg—
The equation $5x^4 - 9x^3 - 4x^2 = 0$ has three real solutions A, B, and C where $A < B < C$.

$A =$ ____________,
$B =$ ____________,
$C =$ ____________.

3. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quad10pet.pg—
The equation

$$x^4 - 10x^2 + 9 = 0$$

has four solutions. Enter them in increasing order:

$x_1 =$ _____
$x_2 =$ _____
$x_3 =$ _____
$x_4 =$ _____

(HINT: Begin by thinking of x^2 as the unknown and treat the original equation as a quadratic. Factor it as $(x^2 - a)(x^2 - b) = 0$, and then solve for x.)

4. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quad6p.pg—
The function $f(x) = -3x^2 + 4x - 8$ is increasing on the interval $(-\infty, A]$ and decreasing on the interval $[A, \infty)$, where A is the input at which f has a horizontal tangent line.

(a) Find A.

$A =$ _____

(b) Does f have a minimum, a maximum, or neither at $x = A$? Enter your answer as MIN, MAX, or NEITHER.

Answer: _____

5. (1 point) —alfredLibrary/AUCI/chapter2/lesson2/quad4p.pg—
The profit in thousands of dollars for a computer company is given by $P(x) = -x^2 + 20x - 24$, where x is thousands of units produced. (For example, $P(2) = 8$ means that the profit is 8 thousand dollars when 2 thousand units are produced.)

(a) Determine how many thousands of units must be produced to yield maximum profit.
Maximum profit at _________ thousand units.

(b) Determine the maximum profit.
Maximum profit is _________ thousand dollars.

Homework 2.3 – Definition and properties of the derivative

1. (1 pt) alfredLibrary/AUCI/chapter2/lesson3/differencequotientbinomial10pet.pg
Compute the derivative of $f(x) = x^2 + 3x + 9$ using the definition of the derivative function.

(HINTS: To enter Δx, type deltax (with no spaces). Write out your work on paper first, then enter your answers. Follow the step-by-step instructions. Copy and paste as much as you can to avoid typing errors. Check your answers frequently.)

$f'(x)$
$= \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$

In the first blank, substitute x $+\Delta x$ into f :

$= \lim_{\Delta x \to 0}$ ________________ – ________ ____________________

In the first blank, FOIL and eliminate parentheses

$= \lim_{\Delta x \to 0}$ ________________ – ________ ____________________

Cancel like terms in the numerator and simplify

$= \lim_{\Delta x \to 0}$ ____________________ ____________________

Cancel like factors in the numerator and denominator:

$\lim_{\Delta x \to 0}$ __________

Let $\Delta x \to 0$:

____

2. (1 pt) alfredLibrary/AUCI/chapter2/lesson3/derivcubic2p.pg

Let $f(x) = 2x^3 + 3x - 10$.

(a) $f'(x) =$ ____________.

(b) The slope of f at $x = -2$ is ____________.

(c) The instantaneous rate of change of f at $x = -2$ is ____________.

(d) The derivative of f at $x = -2$ is ____________.

(e) $f'(-2) =$ ____________.

3. (1 pt) alfredLibrary/AUCI/chapter2/lesson3/derivcubic5pet.pg
Let $f(x) = (2x^2 - 5)(6x + 6)$, and note that f is a product of two functions. Eventually we will derive a "product rule," but for now, you must multiply out the right-hand side before differentiating.

Therefore, $f'(x) =$ ____________________,

and $f'(4) =$ ____________________.

4. (1 pt) alfredLibrary/AUCI/chapter2/lesson3/derivcubic6pet.pg
If $f(x) = x^3 + 4x^2 + 3$,

then $f''(x) =$ ______________.

Homework 2.4 – Analyzing Cubic Functions

1. (1 pt) alfredLibrary/AUCI/chapter2/lesson4/quiz/cubes1pet.pg
(a) Factor the difference of cubes:

$x^3 - 125 =$ ______

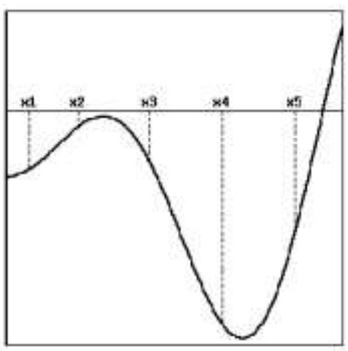
(b) Factor the sum of cubes:

$x^3 + 64 =$ ______

2. (1 pt) alfredLibrary/AUCI/chapter2/lesson4/quiz/question8pet.pg
Find all of the zeros (roots, x -intercepts) of the function $f(x) = x^3 + 5x^2 - 6x$. If there is more than one answer, then enter them as a comma separated list. ENTER EXACT ANSWERS, not decimal approximations. If there are no zeros, then enter the word NONE.

$x =$ ______

3. (1 pt) alfredLibrary/AUCI/chapter2/lesson4/quiz/question6pet.pg
Given the graph of $y = f(x)$ below, fill in the blanks with the marked x-values at which the given condition is true. For each part, enter your answer as a comma-separated list, e.g., **x1,x3,x5**. Enter the word NONE if no points satisfy the given condition.



(a) $f(x) > 0$ at $x =$ ______.

(b) $f'(x) > 0$ at $x =$ ______.

(c) $f(x)$ is increasing at $x =$ ______.

(d) $f'(x)$ is increasing at $x =$ ______.

(e) The slope of $f(x)$ is negative at $x =$ ______.

(f) The slope of $f'(x)$ is negative at $x =$ ______.

4. (1 pt) alfredLibrary/AUCI/chapter2/lesson4/concavity1bpet.pg
Let $f(x) = x^3 - 4x^2 + 6x + 1$.

Perform a number-line sign test for the second derivative to find the x-coordinates of inflection points and the open intervals on which f is concave up or down.

(a) f is concave up on the interval(s) ______.

(b) f is concave down on the interval(s) ______.

(c) The inflection points occur at $x =$ ______.

Notes: In the first two blanks, your answer should either be a single interval, such as (0,1), a comma separated list of intervals, such as (-inf, 2), (3,4), or the word NONE. In the last blank, your answer should be a comma separated list or the word NONE.

5. (1 pt) alfredLibrary/AUCI/chapter2/lesson4/graphanalysis1pet.pg
Suppose that $f(x) = x^3 - 9x^2 + 2$.

(a) List all the critical points of f. If there are no critical points, then enter the word NONE:
$x =$ ______

(Now perform a number-line sign test for the derivative function.)

(b) Use **interval notation** to indicate where f is increasing:

______

(c) Use interval notation to indicate where f is decreasing:

______

(d) List the x-values of all local maxima of f. If there are no local maxima, then enter the word NONE:
$x =$ ______

(e) List the x-values of all local minima of f. If there are

(Now perform a number-line sign test for the second derivative function.)

(f) Use interval notation to indicate where f is concave up:

______

(g) Use interval notation to indicate where f is concave down:

______

(h) Find all inflection points of f. If there are no inflection points, then enter the word NONE:
$x =$ ______

(i) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box: ___

Homework 2.5 – Linear Approximation

1. (1 pt) alfredLibrary/AUCI/chapter2/lesson5/leibniz2pet.pg

NOTE: Units are required in the answer blank on the right side of each equal sign. Complete this problem on paper first so you can practice writing Leibniz notation.

The position s (in miles) of a car at time t (in hours) is given by

$$s(t) = -8t^3 - 5t^2 + 5t - 4.$$

(a) The velocity v of the car is given by the formula

$\frac{\_\_}{\_\_} = \_\_\_\_$

(b) The velocity of the car at time $t = 6.5$ hours is

$\left.\frac{\_\_}{\_\_}\right|_{t=\_\_} = \_\_\_\_$

(c) The acceleration of the car is given by the formula

$\frac{\_\_}{\_\_} = \_\_\_\_$

(d) The acceleration of the car at 6.5 hours is

$\left.\frac{\_\_}{\_\_}\right|_{t=\_\_} = \_\_\_\_$

2. (1 pt) alfredLibrary/AUCI/chapter2/lesson5/differential2p.pg

Recall that

$\Delta y = y(x+\Delta x) - y(x)$ and $dy = y'(x)dx.$

Let $y = 2x^2$.

(a) Find Δy when $x = 2$ and $\Delta x = 0.4$:

$\Delta y =$ ____

(b) Find the differential dy when $x = 2$ and $dx = 0.4$:

$dy =$ ____

3. (1 pt) alfredLibrary/AUCI/chapter2/lesson5/errorprop2p.pg

The radius of a circular disk is measured as 24 cm with a maximum error in measurement of ± 0.1 cm. Use differentials to estimate the propagated error and the relative error in the calculated area of the disk.

Propagated error $\approx \pm$ ____ square centimeters

Relative error (as a unitless decimal) $\approx \pm$ ____

4. (1 pt) alfredLibrary/AUCI/chapter2/lesson5/error10pet.pg

An oil tank in the form of a right circular cylinder of radius of r has a height h of 37 meters and a volume of $V = 37\pi r^2$. The radius is measured as 12 meters with a maximum possible error of ± 0.1 meters. Estimate the propogated and relative errors in the calculated volume of the tank.

Propagated error $\approx \pm$ ____ (Your answer requires **units**.)

Relative error (as a percentage) $\approx \pm$ ____

Homework 2.6 – Integrals of Linear and Quadratic Functions

1. (1 pt) alfredLibrary/AUCI/chapter2/lesson6/question21pet.pg
Evaluate the following indefinite integrals:

(a) $\int(-1t+5)\,dt =$ ________

(b) $\int(5t^2+6t+8)\,dt =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter2/lesson6/question31pet.pg
Evaluate the following definite integrals using the Fundamental Theorem of Calculus:

(a) $\int_{-9}^{-8}(6u-4)\,du =$ ________ $\Big|$ ________ $=$ ________

(b) $\int_{-2}^{4}(-4u+8)\,du =$ ________ $\Big|$ ________ $=$ ________

3. (1 pt) alfredLibrary/AUCI/chapter2/lesson6/defintegraloflinear4p.pg
A population of cattle is increasing at a rate of $P'(t) = 600+70t$ cows per year, where t is measured in years. By how much does the population increase between the 5th and the 8th years?

Total Increase = ____________ cows

4. (3 pts) alfredLibrary/AUCI/chapter2/lesson6/rectilinearmotion1pet.p
All of your answers require **units**.

A stone is thrown straight up from the edge of a roof, 175 feet above the ground, at a speed of 16 feet per second. Recall that the acceleration due to gravity is -32 feet per second squared.

(a) Find the equation for the object's velocity using the relationship $v = \int -32dt$, remembering that the initial velocity is 16 feet per second. ____________

(b) Find the equation for the object's position above the ground using the relationship $s = \int v dt$, remembering that the initial position is 175 feet. ____________

(c) How high is the stone after 2 seconds? ____________

(d) What is the velocity of the stone after 2 seconds? ____________

(e) At what time does the stone hit the ground? (i.e., when is its position zero?) ____________

(f) What is the velocity of the stone when it hits the ground? ____________

(g) The net change in the stone's position from time 0 to time 2 is

$s(\_\_)-s(\_\_)$

$= \int_{\_\_}^{\_\_}$ ____ dt

$=$ ____ $\Big|$ ____

$=$ ____________

5. (1 pt) alfredLibrary/AUCI/chapter2/lesson6/riemannunits1pet.pg
The function $W'(t) = 20t^3\ \frac{\text{L}}{\text{hr}}$ measures the rate at which water is flowing through a pipe at time t hr. Although we have not proved it yet, the Fundamental Theorem works for quadratic and cubic functions. That is, the net amount of water that has flowed through the pipe from $t = 2.5$ hr to $t = 6.1$ hr is given by

$W(\ \_\_\ )-W(\ \_\_\ ) = \int_{\_\_}^{\_\_}(\ \_\_\_\ )\ dt$

Since we do not yet know an antiderivative W of the cubic function W', we will estimate the integral using left-hand and right-hand approximations. Divide the interval [2.5, 6.1] into 4 subintervals of equal width $\Delta t =$ ___.

The left-hand approximation is given by

$L_4 = ($
___ +
___ +
___ +
___
$)\cdot$ ___ =

____

(Include **units** in your final answer.)

The right-hand approximation is given by

$R_4 = ($
___ +
___ +
___ +
___
$)\cdot$ ___ =

____

(Include **units** in your final answer.)

By the way, the exact answer is 6727.61 L. How close are the left- and right-hand approximations to the exact answer?

Homework 3.1 – Power Functions

1. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/rationalexponent1pet.pg

(a) Rewrite $f(x)$ as a power function, and then find its derivative using the power rule.

$f(x) = -5 \cdot \sqrt[9]{x^{19}} =$ ___ x ___

$\dfrac{df}{dx} =$ ___ x ___

(b) Rewrite $g(x)$ as a power function, and then find its derivative using the power rule.

$g(x) = -4 \cdot \sqrt[2]{x^{16}} =$ ___ x ___

$\dfrac{dg}{dx} =$ ___ x ___

2. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/quiz/power3pet.pg

Compute the following derivatives.

(a) $\dfrac{d}{dx}(x^{9/6}) =$ ________

(b) $\dfrac{d}{dx}(x^{-8/9}) =$ ________

3. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/power7pet.pg

(a) If $f(r) = \dfrac{5}{9r^3} + \dfrac{5}{7r^5}$, then $f'(3) =$ ________.

(b) If $g(t) = 7t^{3/5} - 8t^{3/7}$, then $g'(1) =$ ________.

4. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/power9pet.pg

(a) If $f(x) = 4 + \dfrac{5}{x} + \dfrac{6}{x^2}$, then $f'(x) =$ ________.

(b) If $g(x) = 3x^4\sqrt{x} + \dfrac{-4}{x^2\sqrt{x}}$, then $g'(x) =$ ________.

5. (1 pt) alfredLibrary/AUCI/chapter3/lesson1/power21pet.pg

The function $f(x) = 9x + 3x^{-1}$ has one local minimum and one local maximum. (To visualize this, graph f on the interval $[-9/3, 9/3]$.)

(a) The function has a local minimum at $x =$ ________. The local minimum is ________.

(b) The function has a local maximum at $x =$ ________. The local maximum is ________.

Homework 3.2 – Polynomial Functions

1. (1 pt) alfredLibrary/AUCI/chapter3/lesson2/quiz/question22pet.pg
Choose T for true or F for false. Notice that your attempts are limited.

[?] Extrema of a polynomial can be found by setting the first derivative equal to zero.
[?] Inflection points of a polynomial can be found by setting the second derivative equal to zero.
[?] A polynomial will always have an extremum.
[?] End behavior of a polynomial is determined by the leading coefficient
[?] End behavior of a polynomial is determined by the term with highest power.

2. (1 pt) alfredLibrary/AUCI/chapter3/lesson2/quiz/question11pet.pg
Compute each of the following for the polynomial

$$f(x) = -4x^8 + 7x^5 + 5x^3 - 4x.$$

(a) $f'(x) =$ ______________________

(b) $f''(x) =$ ______________________

(c) $f'(5) =$ ______________________

3. (1 pt) alfredLibrary/AUCI/chapter3/lesson2/cp1pet.pg
Let $f(x) = 2x^3 + 3x^2 - 120x$. Enter multiple answers as a comma-separated list.

(a) The critical numbers of f are $x =$ _____.

(b) The values of x for which f has a horizontal tangent line are $x =$ _____.

(c) f has a relative maximum at $x =$ _____.

(d) f has a relative minimum at $x =$ _____.

(e) f has an inflection point at $x =$ _____.

4. (1 pt) alfredLibrary/AUCI/chapter3/lesson2/prob6pet.pg
The equation of motion of a particle is $s(t) = t^3 - 3t$, where s is in meters and t is in seconds. Assume that $t \geq 0$.

(a) Find the velocity v as a function of t.

$v(t) =$ _________ m/s

(b) Find the acceleration a as a function of t.

$a(t) =$ _________ m/s^2

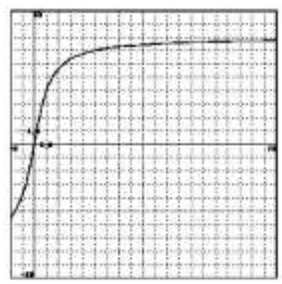
(c) Find the acceleration after 2 seconds.

$a(2) =$ _________ m/s^2

(d) Find the acceleration when the velocity is 0.

$a =$ _________ m/s^2

5. (1 pt) alfredLibrary/AUCI/chapter3/lesson2/horizontalasymptote1pe
Try to determine the end behavior of the function $f(x)$ in the positive direction by looking at its graph shown below.



$$\lim_{x\to\infty} f(x) = \_\_\_$$

6. (1 pt) alfredLibrary/AUCI/chapter3/lesson2/endbehavior1pet.pg

Determine the end behavior of the indicated functions by evaluating the limits at infinity and negative infinity. Enter INF for ∞ and -INF for $-\infty$. (HINT: The end behavior of a polynomial is determined by the term with the highest power.)

(a) $\lim_{x\to\infty} \left(36x^2 - 36x^6\right) =$ _____

(b) $\lim_{x\to-\infty} \left(36x^2 - 36x^6\right) =$ _____

(c) $\lim_{x\to\infty} (20x^2 - 17x^3) =$ _____

(d) $\lim_{x\to-\infty} (20x^2 - 17x^3) =$ _____

Homework 3.3 – Composite Functions

1. (1 pt) alfredLibrary/AUCI/chapter3/lesson3/quiz/chain1p.pg

Consider the following statements:

(a) An environmental study in a community shows that the level of a certain pollutant in the air increases by 0.2 parts per million for every 10 people added to the population.

(b) Census data for the community shows that the population of the community is increasing by 15 people per month.

(c) Therefore, the pollutant is increasing at a rate of 0.3 parts per million per month.

If pollutant level is measured by the variable L in parts per million (ppm), the population is measured by the variable P in heads (h), and time is measured by t in months (mon), then interpret each of the statements above in Leibniz derivative notation:

(a) $\boxed{?}$ = ____ $\boxed{?}$
(b) $\boxed{?}$ = ____ $\boxed{?}$
(c) $\boxed{?}$ = ____ $\boxed{?}$

2. (1 pt) alfredLibrary/AUCI/chapter3/lesson3/quiz/chain0pet.pg

If $y = -7\left(x^2+8x+6\right)^3$, then by the chain rule,

$$\frac{dy}{dx} = \_\_ \left(\_\_\_\right) \_\_ \left(\_\_\_\right)$$

3. (1 pt) alfredLibrary/AUCI/chapter3/lesson3/chain9p.pg

If $f(x) = (x^3+2x+3)^2$,

then $f'(x) =$ ________________.

4. (1 pt) alfredLibrary/AUCI/chapter3/lesson3/chain11pet.pg

(a) If

$$f(x) = -3\sqrt[20]{(3x^2+2x-2)^{19}} = -3\left(3x^2+2x-2\right) \_\_$$

then by the chain rule,

$$\frac{df}{dx} = \_\_ \left(\_\_\_\right) \_\_ \left(\_\_\_\right)$$

(b) If

$$g(x) = \frac{-3}{\sqrt[20]{(3x^2+2x-2)^{19}}} = -3\left(3x^2+2x-2\right) \_\_$$

then by the chain rule,

$$\frac{dg}{dx} = \_\_ \left(\_\_\_\right) \_\_ \left(\_\_\_\right)$$

5. (1 pt) alfredLibrary/AUCI/chapter3/lesson3/chain12pet.pg

Recall the **square root rule**: If $y = \sqrt{x}$, then $y' = \frac{1}{2\sqrt{x}}$.

By the chain rule, if $y = \sqrt{g(x)}$, then $y' = \frac{1}{2\sqrt{g(x)}} \cdot g'(x) = \frac{g'(x)}{2\sqrt{g(x)}}$.

Use this fact to find the derivative of $y = \sqrt{4x^2+3x+7}$. (In other words, try to use the square root rule instead of the power rule.)

$y' =$ ________________

6. (1 pt) alfredLibrary/AUCI/chapter3/lesson3/chain8pet.pg

Recall the **reciprocal rule**: If $y = \frac{1}{x}$, then $y' = -\frac{1}{x^2}$.

By the chain rule, if $y = \frac{1}{g(x)}$, then $y' = -\frac{1}{g(x)^2} \cdot g'(x) = -\frac{g'(x)}{g(x)^2}$.

Use this fact to find the derivative of $y = \frac{1}{4x^3-3}$. (In other words, try to use the reciprocal rule instead of the power rule.)

$y' =$ ____________

Homework 3.4 – Products of Functions

1. **(1 pt) alfredLibrary/AUCI/chapter3/lesson4/productpet3.pg**
If $f(x) = (6x^2 - 3)(6x + 4)$, then by the product rule,

$f'(x) =$ ____________________,

and $f'(1) =$ ____________________.

2. **(1 pt) alfredLibrary/AUCI/chapter3/lesson4/productpet4.pg**
If $f(x) = (9x^2 - 7)^5 (4x^2 - 8)^{15}$,

then $f'(x) =$ ______________________________.

(Don't forget to use the chain rule when you differentiate each factor.)

3. **(1 pt) alfredLibrary/AUCI/chapter3/lesson4/productpet5.pg**
If $f(x) = (2x - 2x^3)(3 + \sqrt{x})$,

then $f'(x) =$ ____________________.

4. **(1 pt) alfredLibrary/AUCI/chapter3/lesson4/product66pet.pg**
The revenue R for a new mobile device during day t after its release is the product of the sales s on that day and the set price p for that day. In this problem, the sales and price both depend on day t , hence so the does the revenue. That is,

$$R(t) = s(t)p(t).$$

On day $t = 60$, the sales were 6193 units and *decreasing* at a rate of 47 units per day. On this same day, the price was 247 dollars per unit and *increasing* at a rate of 2 dollars per unit per day.

By the product rule, the revenue was changing at the rate of

$R'(60) =$ ________ dollars per day.

(HINT: Find $R'(t)$ using the product rule, then plug in the given information.)

5. **(1 pt) alfredLibrary/AUCI/chapter3/lesson4/quiz/product66pet.pg**
The force F on an object is the product of the mass m and the acceleration a . In this problem, assume that the mass and acceleration both depend on time t , hence so does the force. That is, $F(t) = m(t)a(t)$.

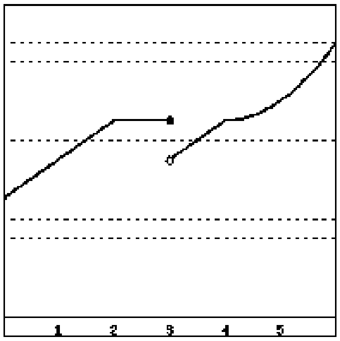
At time $t = 9$ seconds, the mass of an object is $44g$ and changing at a rate of $1g/s$. At this same time, the acceleration is $16m/s^2$ and changing at a rate of $-7m/s^3$.

By the product rule, the force on the object is changing at the rate of

$F'(9) =$ ________ (Your answer requires units. If there are two units multiplied together be sure to put the * between them).

Homework 3.5 – Piecewise Functions

1. **(1 pt) alfredLibrary/AUCI/chapter3/lesson5/quiz/question5pet.pg**
Recall that a function is discontinuous at $x = a$ if the graph has a break, jump, or hole at a. Also recall that a function is non-differentiable at $x = a$ if it is not continuous at a or if the graph has a sharp corner or vertical tangent line at a.



(a) At which x-values does the function above appear to be discontinuous? $x =$ _____
(b) At which x-values does the function appear to be non-differentiable? $x =$ _____
Enter multiple answers as a comma-separated list. If there are no x-values that apply, then enter the word 'none' (without quotes).

2. **(1 pt) alfredLibrary/AUCI/chapter3/lesson5/limits5pet.pg**

Let $f(x) = \begin{cases} 2x+1, & \text{if } x \le -1 \\ x+3, & \text{if } -1 < x \le 2 \\ 2x-3, & \text{if } 2 < x \end{cases}$

Calculate the following function values:

(a) $f(-5) =$ _______

(b) $f(-1) =$ _______

(c) $f(0.5) =$ _______

(d) $f(2) =$ _______

(e) $f(5) =$ _______

3. **(1 pt) alfredLibrary/AUCI/chapter3/lesson5/limits6pet.pg**
The expression, $\lim_{x\to a} f(x)$, is called a "two-sided limit." A two-sided limit is said to "exist" if the one-sided limits are finite and equal, that is, if there is a finite number L such that

$$\lim_{x\to a^-} f(x) = \lim_{x\to a^+} f(x) = L$$

We we see later that for a function to be continuous at $x = a$, the function $f(x)$ must be defined at a, and the two-sided limit at a must exist.

Let $f(x) = \begin{cases} -x-2, & \text{if } x \le -3 \\ 2x+3, & \text{if } -3 < x \le 2 \\ x-2, & \text{if } 2 < x \end{cases}$

(a) Calculate the following limits. Enter DNE if the limit does not exist.

$\lim_{x\to -3^-} f(x) =$ _____

$\lim_{x\to -3+} f(x) =$ _____

$\lim_{x\to -3} f(x) =$ _____

(b) Calculate the following limits. Enter DNE if the limit does not exist.

$\lim_{x\to 2^-} f(x) =$ _____

$\lim_{x\to 2+} f(x) =$ _____

$\lim_{x\to 2} f(x) =$ _____

(c) Based on part (a), is $f(x)$ continuous at $x = -3$?

(enter "yes" or "no") ___

(d) Based on part (b), is $f(x)$ continuous at $x = 2$?

(enter "yes" or "no") ___

4. **(1 pt) alfredLibrary/AUCI/chapter3/lesson5/question3pet.pg**
For what value of the constant c is the function f continuous on the interval $(-\infty, \infty)$? (HINT: The two pieces of the graph must connect at c.)

$$f(x) = \begin{cases} x^2-7, & x \le c \\ 2x-8, & x > c \end{cases}$$

$c =$ __________

5. **(1 pt) alfredLibrary/AUCI/chapter3/lesson5/question33pet.pg**

Let $f(x) = \begin{cases} 4, & \text{if } x < -3 \\ x+4, & \text{if } -3 \le x < 3 \\ 5-x^2, & \text{if } x \ge 3 \end{cases}$

Compute $\int_{-6}^{5} f(x)dx$ by expressing it as a sum of integrals. It may be helpful to view the graph of $f(x)$.

$\int_{-6}^{5} f(x)dx =$ ________________

Homework 3.6 – Integrals of Polynomials

1. (1 pt) alfredLibrary/AUCI/chapter3/lesson6/anti1.pg

Evaluate the indefinite integral using the power rule for integration:

$$\int 5s^4 - 5s^5\, ds = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.$$

2. (1 pt) alfredLibrary/AUCI/chapter3/lesson6/anti4.pg

Evaluate the indefinite integral by writing each term as a power function and then using the power rule:

$$\int \frac{4}{x^5} - 7\sqrt[3]{x^2}\, dx = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.$$

3. (1 pt) alfredLibrary/AUCI/chapter3/lesson6/IVP1pet.pg

Recall that $\int f(x)dx$ represents the infinite family of antiderivatives of f, each identified by its constant of integration, C. Given a point in the plane, we could find the constant C that identifies the unique member of the family passing through the given point.

Consider the function $f(x) = \frac{2}{x^3} - \frac{6}{x^5}$, and suppose $F(x)$ is the antiderivative of $f(x)$ such that $F(1) = 0$ (i.e., the graph passes through the point $(1, 0)$). Then

$F(x) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_$

4. (1 pt) alfredLibrary/AUCI/chapter3/lesson6/anti4pet.pg

Use the fundamental theorem of calculus to evaluate the definite integral.

$$\int_3^9 \frac{10}{\sqrt{x}}\, dx = \_\_\_\_\_\_ \Big| \_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_$$

5. (1 pt) alfredLibrary/AUCI/chapter3/lesson6/definite11pet.pg

Suppose an object is moving along a line with velocity $v(t) = -t^2 + 7t - 12$ miles per hour. Find the displacement and the total distance traveled by the object during the time interval $[2, 11]$.

Displacement = _________ miles

Total distance traveled = _________ miles

HINT: To compute the total distance traveled, you must integrate the speed, which is $|v(t)|$. To do this, you must find the zeros of v on the interval $[2, 11]$, and then find the intervals on which the velocity is positive or negative by performing a sign test. By the definition of absolute value, $|v(t)| = v(t)$ when the velocity is positive, and $|v(t)| = -v(t)$ when velocity is negative. It may help to view a graph.

Homework 4.1 – Analyzing Rational Functions

1. (1 pt) alfredLibrary/AUCI/chapter4/lesson1/quiz/combine1pet.pg

Consider the expression $\frac{x^2}{x-3} - \frac{4}{x-4}$.

(a) Combine the two terms and enter the result in *reduced* form as a ratio of polynomials by eliminating all parentheses. (Hint: Find a common denominator.)

$$\frac{x^2}{x-3} - \frac{4}{x-4} = \_\_\_\_\_\_\_\_$$

(b) Use long division to rewrite the answer to part (a) in proper form, $Q(x) + \frac{R(x)}{D(x)}$, where $D(x) = x^2 - 7x + 12$.

$\frac{x^2}{x-3} - \frac{4}{x-4} =$ ____ + __________ $x^2 - 7x + 12$

2. (1 pt) alfredLibrary/AUCI/chapter4/lesson1/quotient5pet.pg

If $f(x) = \frac{\sqrt{x}-7}{\sqrt{x}+7}$, then by the quotient rule,

$f'(x) =$ ________________

3. (1 pt) alfredLibrary/AUCI/chapter4/lesson1/quotientapplication1pet.pg

A drug is injected into the bloodstream of a patient. The concentration (in milligrams per cubic centimeter) of the drug in the bloodstream t hours after the injection is given by

$$C(t) = \frac{0.16t}{t^2+6}.$$

(a) By the quotient rule, the rate of change of the drug concentration with respect to time after a half hour is

______________ mg per cubic cm per hr.

(b) How fast is the drug concentration changing after 3 hours?

______________ mg per cubic cm per hr

4. (1 pt) alfredLibrary/AUCI/chapter4/lesson1/quotientapplication2pet.pg

The pressure on an object P in Pascals (Pa) is proportional to the temperature T in degrees Celsius (C) and inversely proportional to the volume V in cubic meters (m^3), where all three quantities depend on time t in seconds (s). That is,

$$P(t) = \frac{T(t)}{V(t)}$$

At time $t = 8$ seconds, the temperature of the object is $66C$ and changing at a rate of $2\frac{C}{s}$. At this same time, the volume is $5m^3$ and changing at the rate $-1\frac{m^3}{s}$. By the quotient rule, the pressure on the object at $t = 8$ seconds is changing at the rate of

$P'(8) =$ ________
units

5. (1 pt) alfredLibrary/AUCI/chapter4/lesson1/graphanalysis22pet.pg

Let $f(x) = \frac{x^2 - (-13)x + 42}{x^2 + 5x + 6}$.

(a) The y -intercept is $y =$ ________

(b) The x -intercept(s) is/are $x =$ ________

(c) The vertical asymptote(s) is/are $x =$ ________

(d) To find the local extrema of f, we set $f'(x) = 0$ and solve for x. In this case,

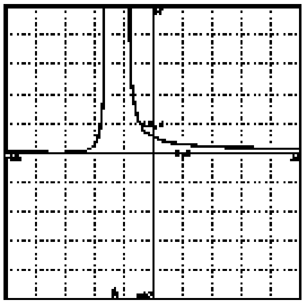
$f'(x) =$ ______________,

and we must find the zeros of the numerator. In reduced form (expanded without parentheses), we must ultimately solve the equation

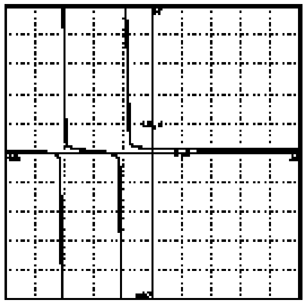
______________ $= 0$.

Therefore, the local extrema are at $x =$ ______________

(e) Use the information from parts (a)-(d) (and without a calculator!) to choose the correct graph of f. $\boxed{?}$



A



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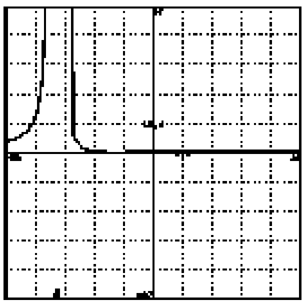

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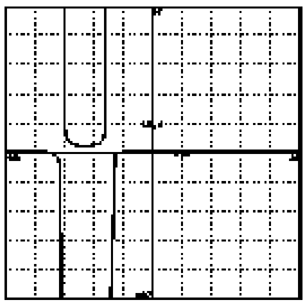
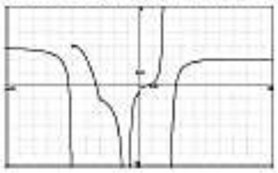


D

Homework 4.2 – Horizontal and Vertical Asymptotes

1. (1 pt) alfredLibrary/AUCI/chapter4/lesson2/question1.pg
Determine each of the given limits for the function f graphed below. Type 'inf' for ∞, '-inf' for $-\infty$, and 'dne' if the limit does not exist. Click on the graph to enlarge the image.



(a) $\lim_{x\to-5^-} f(x) =$ ________
(b) $\lim_{x\to-5^+} f(x) =$ ________
(c) $\lim_{x\to-5} f(x) =$ ________
(d) $\lim_{x\to-3} f(x) =$ ________
(e) $\lim_{x\to-1^-} f(x) =$ ________
(f) $\lim_{x\to-1^+} f(x) =$ ________
(g) $\lim_{x\to-1} f(x) =$ ________
(h) $\lim_{x\to2^-} f(x) =$ ________
(i) $\lim_{x\to2^+} f(x) =$ ________
(j) $\lim_{x\to2} f(x) =$ ________
(k) $\lim_{x\to\infty} f(x) =$ ________
(l) $\lim_{x\to-\infty} f(x) =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter4/lesson2/analyzegraph2pet.pg
Let $g(x) = \dfrac{1}{(x+6)^3}$.

(a) Complete the table below for x-values close to -6. If a value is undefined, enter *NONE*.

x	-7	-6.1	-6.01	-6	-5.99	-5.9	-5
$g(x)$	____	____	____	____	____	____	____

(b) Based on the values in the table, $g(x) \to$ ____ () as $x \to -6$ from the left.

(c) Based on the values in the table, $g(x) \to$ ____ () as $x \to -6$ from the right.

(d) Complete the two tables below to see how $g(x)$ behaves in the long-run. If a value is undefined, enter *NONE*. Enter exact answers using fractions instead of long decimal answers.

x	10	100	1000
$g(x)$	____	____	____

x	-10	-100	-1000
$g(x)$	____	____	____

(e) Based on the values in your table, $g(x) \to$ ____ () as x takes on larger and larger positive values.

(f) Based on the values in your table, $g(x) \to$ ____ () as x takes on larger and larger negative values.

(g) The vertical asymptote(s) is/are $x =$ ____ ()

(h) The horizontal asymptote(s) is/are $y =$ ____. ()

3. (1 pt) alfredLibrary/AUCI/chapter4/lesson2/quiz/question2.pg

Analyze the behavior of the function $y = \frac{4x+32}{x^2+(-13)x+40}$ near the vertical asymptote $x = 8$. Enter 'inf' if the limit is ∞, enter '-inf' if the limit is $-\infty$, and enter 'dne' if the limit does not exist.

(a) $\lim_{x\to8^-} \frac{4x+32}{x^2+(-13)x+40} =$ ________

(b) $\lim_{x\to8^+} \frac{4x+32}{x^2+(-13)x+40} =$ ________

(c) $\lim_{x\to8} \frac{4x+32}{x^2+(-13)x+40} =$ ________

4. (1 pt) alfredLibrary/AUCI/chapter4/lesson2/analyzegraph1pet.pg
Instructions:

- If you are asked for a function, then enter a function.
- If you are asked to find x - or y -values, then enter either a number or a list of numbers separated by commas. If there are no solutions, enter *None* .
- If you are asked to find an interval or union of intervals, then use **interval notation**. Enter { } if an interval is empty.
- If you are asked to find a limit, then enter either a number, 'inf' for ∞, '-inf' for $-\infty$, or 'dne' if the limit does not exist

Let $f(x) = \frac{5x^2}{x^2-16}$.

(a) Calculate the first derivative of f. (At this point, it would be wise to simplify the numerator by eliminating parentheses and combining like terms.)

$f'(x) =$ ____________

(b) List all of the points where $f'(x)$ is zero or undefined (Hint: Find the zeros of the numerator and the zeros of the denominator. The points in this list that are also in the domain of f are called "critical points."):

$x =$ ____________

(c) Use the points from (b) and sign tests to find the intervals on which f is increasing and the intervals on which f is decreasing (Hint: Your answers must exclude any points where f' is undefined.):

f is increasing on ____________.

f is decreasing on ____________

(d) Enter the inputs for the local extrema:

Local maximum at $x =$ ____________

Local minimum at $x =$ ____________.

(e) Find the following left- and right-hand limits at the vertical asymptote $x = -4$.

$$\lim_{x\to -4^-} \frac{5x^2}{x^2-16} = \boxed{?} \quad \lim_{x\to -4^+} \frac{5x^2}{x^2-16} = \boxed{?}$$

(f) Find the following left- and right-hand limits at the vertical asymptote $x = 4$.

$$\lim_{x\to 4^-} \frac{5x^2}{x^2-16} = \boxed{?} \quad \lim_{x\to 4^+} \frac{5x^2}{x^2-16} = \boxed{?}$$

(g) Find the following limits at infinity to determine any horizontal asymptotes.

$$\lim_{x\to -\infty} \frac{5x^2}{x^2-16} = \boxed{?} \quad \lim_{x\to +\infty} \frac{5x^2}{x^2-16} = \boxed{?}$$

(h) Calculate the second derivative of f. (At this point, it would be wise to simplify the numerator by eliminating parentheses and combining like terms.)

$f''(x) =$ ____________

(i) List the points where the second derivative is zero or undefined:

$x =$ ________

(j) Use these points and sign tests to find the intervals of concavity:

f is concave up on ____________.

f is concave down on ____________

(k) Complete the following for the function f.

The domain of f is ____________.

The y-intercept is ____________.

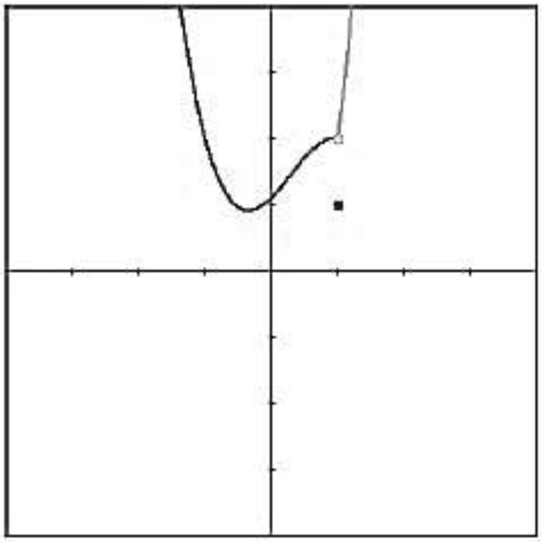
The x-intercepts are ____________.

(l) Sketch a graph of the function f without using a graphing calculator. Plot the y-intercept and the x-intercepts, if any exist. Draw dashed lines for horizontal and vertical asymptotes. Plot the points where f has local maxima, local minima, and inflection points. Use what you know about intervals of increase/decrease and concavity to sketch the remaining parts of the graph of f.

Homework 4.3 – Continuity and L'Hôpital's Rule

1. (1 pt) alfredLibrary/AUCI/chapter4/lesson3/continuous10pet.pg

Let f be the function below.



Note: you can click on the graph to get a larger image.

Determine the following for the function f at $x = 1$.

$\lim_{x\to 1^-} f(x) =$ _____

$f(1) =$ _____

$\lim_{x\to 1^+} f(x) =$ _____

Is this function continuous at $x = 1$? _____

2. (1 pt) alfredLibrary/AUCI/chapter4/lesson3/quiz/question11pet.pg

Find the constant c that makes f continuous everywhere.

$$f(x) = \begin{cases} cx^2 + 7x, & x < 2 \\ x^3 - cx, & x \geq 2 \end{cases}$$

$c =$ __________

3. (1 pt) alfredLibrary/AUCI/chapter4/lesson3/applyhospitals.pg

For which of the following limits is it appropriate to use l'Hospital's rule? Note that you have a limited number of attempts.

- A. $\lim_{x\to\infty} \frac{x^2-3x+2}{x^2+5x-14}$
- B. $\lim_{x\to 2} \frac{x^2+8x-9}{x^2+6x-7}$
- C. $\lim_{x\to 2} \frac{x^2-4x+4}{x^2-3x+2}$
- D. $\lim_{x\to 2} \frac{x^2+6x-7}{x^2+16x+63}$
- E. $\lim_{x\to-\infty} -\frac{9}{-7x+1}$
- F. $\lim_{x\to 2} \frac{x^2+7x-18}{x^2-4x+4}$

4. (1 pt) alfredLibrary/AUCI/chapter4/lesson3/quiz/lhopitals2pet.pg

Suppose that direct substitution into a given limit yields the indeterminate form $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$. Then we can apply L'Hopital's rule.

Suppose that direct substitution into the result yields the indeterminate form $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$. Then we can apply L'Hopital's rule again, and so on...

That is, we can continue to apply L'Hopital's rule as long as the resulting limit has the form $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$, so **be sure to check the limit each time you apply the rule!**

Compute the limit below. You will need to apply L'Hopital's rule twice.

$\lim_{x\to\infty} \frac{-7x^2+3x+7}{2x^2-6x-5} = \lim_{x\to\infty}$ __________ ______________________

$= \lim_{x\to\infty}$ __________ ______________________

$=$ __________

(Be sure that you understand why you need to use L'Hopital's rule two times for this limit, and why you cannot use it a third time!)

5. (1 pt) alfredLibrary/AUCI/chapter4/lesson3/lhopitals10pet.pg

Use L'Hopital's rule to evaluate each limit.

(a) $\lim_{x\to-7} \frac{-5x^2-44x-63}{x+7} = \lim_{x\to-7}$ __________ ________________

$=$ __________

(b) $\lim_{x\to 2} \frac{2x^2+2x-12}{(x-2)(x-1)} = \lim_{x\to 2}$ __________ ____________________

$=$ __________

Homework 5.1 – Exponential Growth and Decay

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/quiz-/exponentials2pet.pg

Use the properties of exponents to complete the following.

(a) The expression $\frac{e^x}{e^{8+x}}$ can be written in the form $e^{f(x)}$, where the exponent $f(x)$ is a function of x. Find $f(x)$.

$f(x) =$ ________

(b) The expression $\left(2^{8x}\right)^{4x}$ can be written in the form $2^{g(x)}$, where the exponent $g(x)$ is a function of x. Find $g(x)$.

$g(x) =$ ________

(c) The expression $8^{2x-1}8^{2-4x}$ can be written in the form $8^{h(x)}$, where the exponent $h(x)$ is a function of x. Find $h(x)$.

$h(x) =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/radioactive1pet.pg

A certain radioactive material decays in such a way that the mass remaining (in grams) after t years is given by the function

$$m(t) = 90e^{-0.03t}$$

(a) The initial mass is ________ grams.

(b) The amount remaining after 40 years is ______ grams.

(c) The decay rate for this material (as a nonnegative percentage) is ______

3. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/poultry2pet.pg

World poultry production was 77.2 million tons in the year 2004 and increasing at a continuous rate of 1.6% per year. Assume that this growth rate continued.

(a) Write an exponential model $P(t)$ for world poultry production in million tons, where t is years since 2004.

$P(t) =$ __________

(b) Use your model to estimate world poultry production in the year 2014.

Production = ____ million tons (Round to the nearest 0.001.)

4. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/asthma1pet.pg

The number of asthma sufferers in the world was about 84 million in 1990 and 130 million in 2001. Let N represent the number of asthma sufferers (in millions) worldwide t years after 1990.

(a) Write N as a linear function of t.
(HINT: You are given two points. Use them to find the slope-intercept equation of the line.)

$N(t) =$ ______________ million people.

(b) How many asthma sufferers are predicted worldwide in the year 2014 with the linear model? Round to the nearest 0.01 million people.

____________ million people.

(c) Write N as a discrete exponential function of t of the form $N(t) = A(1+r)^t$.
(HINT: You will need to find $(1+r)$, where r is the rate. Use $N(11) = 130$ and the initial value $N(0) = 84$ to find it.)

$N(t) =$ ______________ million people.

(d) How many asthma sufferers are predicted worldwide in the year 2014 with the exponential model? Round to the nearest 0.01 million people.

____________ million people.

5. (1 pt) alfredLibrary/AUCI/chapter5/lesson1/explimit1pet.pg

Compute each of the following limits at infinity. If your answer is ∞ or $-\infty$, then enter 'inf' or '-inf,' respectively. (HINT: First evaluate the limit of the exponent in the exponential function.)

(a) $\lim_{t\to\infty}\left(12e^{-0.1t} + 13\right) =$ ____

(b) $\lim_{t\to\infty}\left(14e^{0.45t} - 9\right) =$ ____

Homework 5.2 – Derivative and Antiderivative of e^x

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/question30pet.pg
If $h(x) = e^{4x}(4 + 2x^5 + 10x^8)$, then $h(x) = f(x)g(x)$, where

$f(x) =$ __________ and $g(x) =$ __________.

By the product rule,

$h'(x) =$ _______ * _______ + _______ * _______

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/quiz/application2pet.pg
The vertical position from equilibrium (in meters) of a hydraulic piston t seconds after a downward force is applied and released is given by the function $D(t) = -2te^{-5t}$.

(a) Find the time at which the piston is at its furthest from equilibrium. That is, find the time at which D has a maximum or minimum.

$t =$ ____________ seconds

(b) Find the position at that time you found in part (a).

$D =$ ____________ meters

3. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/criticalinflectionpoint1pet.pg
Let $f(x) = \frac{4e^x}{4+e^x}$. If necessary, enter INF for ∞, -INF for $-\infty$, or NONE.

(a) $f'(x) =$ ____________________.

(b) The open interval of increase for $f(x)$ is __________.

(c) The open interval of decrease for $f(x)$ is __________.

(d) $f(x)$ has a local minimum at __________.

(e) $f(x)$ has a local maximum at __________.

(f) $f(x)$ has horizontal asymptotes at $y =$ __________.
(HINT: Set up the limits at ∞ and $-\infty$. Notice that one limit can be evaluated directly, and the other is well-suited for L'Hopital's rule.)

4. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/limit1pet.pg

Determine if the function $y = \frac{8}{e^x-1}$ has any horizontal asymptotes by evaluating the following limits. If necessary, enter 'INF' for ∞ and '-INF' for $-\infty$. (HINT: Note that l'Hopital's rule does not apply to either limit. You must first determine the limit of the exponential term in the denominator.)

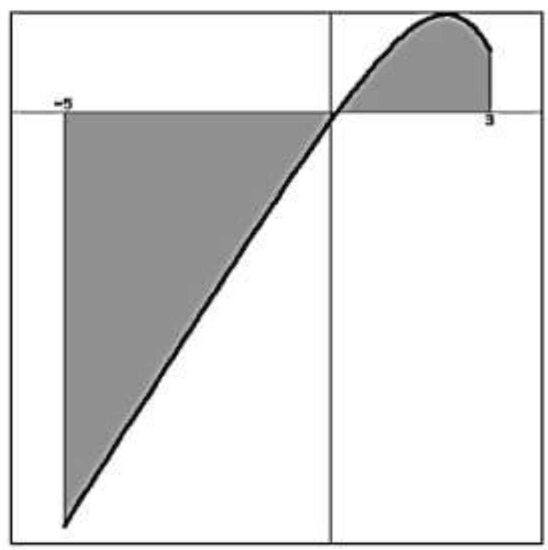
(a) $\lim_{x\to+\infty} \frac{8}{e^x-1} =$ _____

Enter the right-hand asymptote, or enter NONE: $y =$ _____

(b) $\lim_{x\to-\infty} \frac{8}{e^x-1} =$ _____

Enter the left-hand asymptote, or enter NONE: $y =$ _____

5. (1 pt) alfredLibrary/AUCI/chapter5/lesson2/integral2pet.pg



(Click on graph to enlarge)

The graph of the function $f(x) = 9x - e^x$ is the thick blue curve shown above. Assuming that the Fundamental Theorem of Calculus holds for exponential functions, use it to find the shaded area.

$\_\_\int\_\_ \quad \_\_\_ \quad dx = \quad \_\_\_ \Big| \quad \_\_\_\_ \quad = \quad \_\_\_\_\_\_\_\_$

Homework 5.3 – Implicit Differentiation and Inverse Functions

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson3/inverseapplication1pet.pg

Let $C = f(q) = 250 + 0.1q$ denote the cost in dollars to manufacture q kilograms of a chemical.

(a) Which of the following statements correctly explain the meaning of $f^{-1}(C)$? Check all that apply.

- A. The number of kilograms of the chemical someone can purchase with C dollars.
- B. The cost of manufacturing C kilograms of the chemical.
- C. The number of kilograms of the chemical that can be manufactured with C dollars.
- D. The cost of manufacturing one kilogram of the chemical.
- E. The number of kilograms of chemical that can be manufactured for each 1 dollar spent.
- F. None of the above.

(b) Find a formula for $f^{-1}(C) =$ ______
(Note that C should be the independent variable in your inverse formula, not q.)

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson3/inversesolve2pet.pg
If $f(x) = \sqrt{x^3 - 9}$, then $f^{-1}(x) =$ ______.

3. (1 pt) alfredLibrary/AUCI/chapter5/lesson3/implicitdrill1pet.pg
Practice implicit differentiation.

(a) If $6x^3 + x^2y - xy^3 = -2$, then the slope of the curve at the point $(1,0)$ is ______.

(b) If $5e^{xy} - 5x = y + 261$, then the rate of change of the curve at the point $(2,2)$ is ______.

(c) If $\sqrt{x} + \sqrt{y} = 7x$, then the slope of the tangent line at the point $(4,676)$ is ______.

4. (1 pt) Library/AlfredUniv/AUCI/chapter5/lesson3-/implicitapplication1pet.pg

Recall, the volume of a sphere is $V = \frac{4}{3}\pi r^3$. If the sphere is increasing in size over time, then we may treat volume and radius as functions of time. That is, $V(t) = \frac{4}{3}\pi[r(t)]^3$.

Suppose the radius of the sphere is increasing at a constant rate of 1.5 centimeters per second. At the moment when the radius is 20 centimeters, the volume is increasing at a rate of ______ cubic centimeters per second.

Homework 5.4 – Logarithmic Functions

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson4/quiz/convert1pet.pg

Recall that $b^x = y$ is equivalent to $log_b y = x$.

(a) The exponential equation $e^{-4} = 0.0183$ is equivalent to the logarithmic equation

$\ln(\_\_\_) = \_\_\_$.

(b) The exponential equation $3^{-5} = 0.0067$ is equivalent to the logarithmic equation

$\log_3(\_\_\_) = \_\_\_$.

(c) The logarithmic equation $\log_{10} 6 = 0.7782$ is equivalent to the exponential equation

___ ___ = ___

(d) The logarithmic equation $\ln 7 = 0.8451$ is equivalent to the exponential equation

___ ___ = ___

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson4/simplifylog1pet.pg

Use the properties of logartithms to rewrite the expression as a single logarithmic function:

(a) $5\log x - 5\log(x^2+1) + 3\log(x-1) = \log\left(\_\_\_\_\_\_\right)$.

(b) $5\log(x+1) - 3\log(x^3+4) - 5\log x = \log\left(\_\_\_\_\_\_\right)$.

3. (1 pt) alfredLibrary/AUCI/chapter5/lesson4/solveexponential1pet.pg

Solve the equation for x.

$$5^{x-1} = 3^{2x+1}$$

$x =$ ______

4. (1 pt) alfredLibrary/AUCI/chapter5/lesson4/criticalpoint1pet.pg

Let $f(x) = \dfrac{e^{2x}+8}{e^x}$.

(a) $f'(x) =$ ______.

(b) The only critical point of f is at $x =$ ______.
(**HINT:** The function e^{kx} is never zero.)

(c) The extreme value at the critical point is ______.

5. (1 pt) alfredLibrary/AUCI/chapter5/lesson4/halflife2pet.pg

Recall, the continuous exponential growth or decay model is $A(t) = A_0 e^{kt}$, where $A_0 = A(0)$ is the initial amount, and k is the exponential rate of decay.

Half-life is the time it takes for the substance to decay to half of its initial amount, so we set $A(t) = 0.5A_0$ and solve for t.

The half-life of Radium-226 is t = 1590 years. If a sample contains 500 mg, how many mg will remain after 1000 years?

______

Homework 5.5 – Derivatives and Antiderivatives of Exponentials and Logarithms

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson5/logchain1pet.pg
Recall, $\frac{d}{dt}(\ln t) = \frac{1}{t}$, but if y is a function of t, then $\frac{d}{dt}(\ln y) = \frac{1}{y} \cdot y' = \frac{y'}{y}$. Use this "short cut" to find each derivative.

(a) $\dfrac{d}{dt}(\ln(t-10)) =$ ________

(b) $\dfrac{d}{dt}(\ln(5t+7)) =$ ________

(c) $\dfrac{d}{dt}(\ln(3t^2+9t+9)) =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson5/logchain2pet.pg

(a) If $f(x) = \sqrt{15+\ln(x)}$, then $f'(3) =$ ________.

(b) If $f(x) = x(3.5)^x$, then $f'(x) =$ ________.

3. (1 pt) alfredLibrary/AUCI/chapter5/lesson5/graphoffunction1pet.pg
Let $f(x) = 5x^2\ln(x)$, for $x > 0$.

(a) The derivative of f is $f'(x) =$ ________, $x > 0$.

(b) The critical numbers of f are $x =$ ____.

4. (1 pt) alfredLibrary/AUCI/chapter5/lesson5/integralofreciprocal2pet.
Evaluate the indefinite integral. You must first rewrite and simplify the integrand!

$$\int \frac{3-8xe^{8x}}{x}\,dx = \_\_\_\_\_\_\_\_.$$

5. (1 pt) alfredLibrary/AUCI/chapter5/lesson5/integralofreciprocal1pet.
Evaluate the definite integral. You must first rewrite and simplify the integrand!

$$\int_1^e \frac{5x^2+6x+9}{x}\,dx = \_\_\_\_\_\_\_\_$$

Homework 5.6 – Definite Integrals of Exponentials and Logarithms

1. (1 pt) alfredLibrary/AUCI/chapter5/lesson6/areaapproximation1pet.pg

Suppose we want to estimate $\int_{-1}^{-0.2}(3x^2-12)dx$ using $n=4$ subintervals of equal width.

(a) The width of each subinterval is $\Delta x =$ ________.

(b) The left-hand approximation is ________.

(c) The right-hand approximation is ________.

(d) The midpoint approximation is ________.

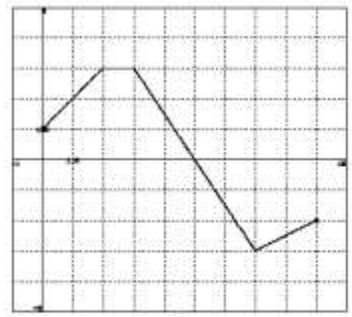
(e) Now find the exact value of the integral using the Fundamental Theorem, and compare your answer with the approximations in parts (b) through (d):

$\int_{-1}^{-0.2}(3x^2-12)dx =$ ________

2. (1 pt) alfredLibrary/AUCI/chapter5/lesson6/definiteintegral1pet.pg

The purpose of this exercise is to help you remember the meaning of the definite integral. You need only compute areas of rectangles and triangles.

The graph of f is shown below. Evaluate each integral by interpreting it in terms of net area. Click on the graph to enlarge the image.



(a) $\int_0^2 f(x)\,dx =$ ____________

(b) $\int_0^5 f(x)\,dx =$ ____________

(c) $\int_5^7 f(x)\,dx =$ ____________

(d) $\int_0^9 f(x)\,dx =$ ____________

3. (1 pt) alfredLibrary/AUCI/chapter5/lesson6/definiteintegral11pet.pg

Use the Fundamental Theorem to evaluate each integral.

(a) $\int_{-1}^{2} e^{3.1x}\,dx =$ ________________

(b) $\int_0^1 8^x\,dx =$ ________________

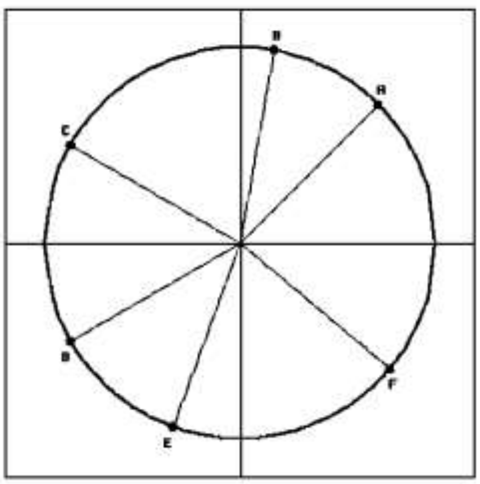
Homework 6.1 – The Cosine and Sine Functions

1. **(1 pt) alfredLibrary/AUCI/chapter6/lesson1/unitcircle1pet.pg**

For each angle listed in the table below, select the letter of the corresponding point on the unit circle, then use your calculator (in degree mode) to compute the values of the x- and y-coordinates of the point.

NOTE: You must compute your answers before you enter them. You may enter exact values or round to 3 decimal places. Answers of the form sin(45), for instance, will not be accepted.

Angle	Point	x-coordinate	y-coordinate
$-150°$	?	____	____
$-400°$	?	____	____
$45°$	?	____	____
$800°$	?	____	____
$150°$	?	____	____
$250°$	?	____	____

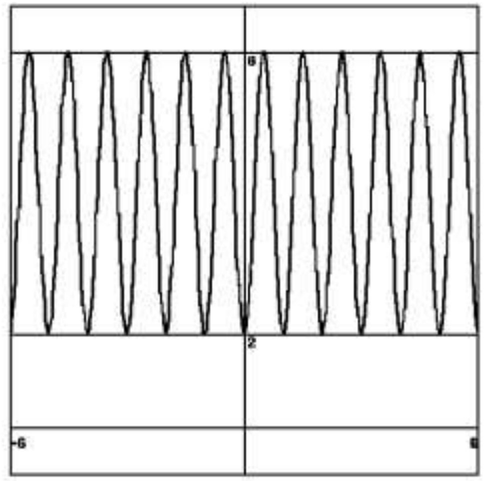


(Click on graph to enlarge)

2. **(1 pt) alfredLibrary/AUCI/chapter6/lesson1/quiz-/trigfunction1pet.pg**

(a) The midline of the graph is the line with equation ____

(b) The amplitude of the graph is ____



(Click on graph to enlarge)

3. **(1 pt) alfredLibrary/AUCI/chapter6/lesson1/quiz/sinusoidal3pet.pg**

If $y = 1\cos(9t + 19) + 4$, then the phase shift of the graph (as C/B) is ____.

4. **(1 pt) alfredLibrary/AUCI/chapter6/lesson1/question2pet.pg**

Suppose $y = 2\pi\cos(-5t + 6) + 9$. In your answers, enter 'pi' for π.

(a) The midline of the graph is the line with equation ____.

(b) The amplitude of the graph is ____.

(c) The period of the graph is ____ .

(d) The phase shift (as C/B) is ____ .

5. **(1 pt) alfredLibrary/AUCI/chapter6/lesson1/sinusoidalapplication2pe**

The pressure P (in pounds per square foot) in a pipe varies over time. Four times an hour, the pressure oscillates from a low of 40 to a high of 300 and then back to a low of 40. The pressure at time $t = 0$ is 40. Let the function $P(t)$ denote the pressure in the pipe at time t (in minutes). Find a possible formula for the function $P(t)$. (HINT: It is important to make a sketch of P over the course of one hour, but note that time is in minutes!)

$P(t) =$ ________

Homework 6.2 – Derivatives and Antiderivatives of Cosine and Sine

1. (1 pt) alfredLibrary/AUCI/chapter6/lesson2/diffe

Trig Identities:

$\sin(x+y) = \sin(x)\cos(y) + \cos(x)\sin(y)$
$\sin(x-y) = \sin(x)\cos(y) - \cos(x)\sin(y)$
$\cos(x+y) = \cos(x)\cos(y) - \sin(x)\sin(y)$
$\cos(x-y) = \cos(x)\cos(y) + \sin(x)\sin(y)$

Compute the derivative of $f(x) = \sin(x)$ usir
of the derivative. For Δx, type 'deltax' with no
be a good idea for you to write out your work c

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

substitute $x + \Delta x$ into sin(x):

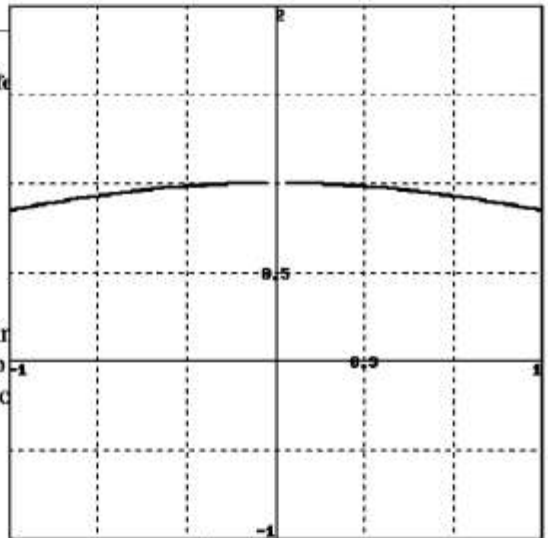
$= \lim_{\Delta x \to 0}$ ____ − ___ ———————— Δx

apply the appropriate trig identity:

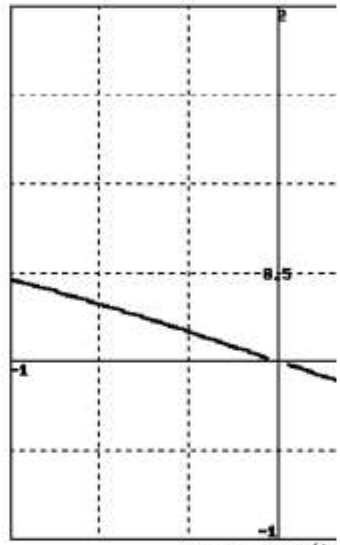
$= \lim_{\Delta x \to 0}$ ______ + ______ − ___ ————————

$= \lim_{\Delta x \to 0} \Big[\sin(x) \Big($ ____ − ___ ———————— $\Delta x \Big) \cos(x) \Big($ ———— $\Delta x \Big) \Big]$

We can compute the limits of the two terms using the following graphs:



Graph of $\frac{\sin(\Delta x)}{\Delta x}$.



Graph of $\frac{\cos(\Delta x}{\Delta x}$

It follows that

$\lim_{\Delta x \to 0} \sin(x) \left(\frac{\cos(\Delta x) - 1}{\Delta x} \right) =$ ______

and

$\lim_{\Delta x \to 0} \cos(x) \left(\frac{\sin(\Delta x)}{\Delta x} \right) =$ ______.

Therefore, $\frac{d}{dx} \sin(x) =$ ______.

2. (1 pt) alfredLibrary/AUCI/chapter6/lesson2/trigchain1pet.pg

(a) If $f(x) = \sin(x^3)$, then $f'(x) =$ __________.

(b) If $g(x) = -9e^{x \sin x}$, then $g'(x) =$ __________.

(c) If $p(x) = \sqrt{2 + \sin^2 x}$, then $p'(x) =$ __________.

(d) If $r(x) = \ln(\cos^2 x)$, then $r'(x) =$ __________.

3. (1 pt) alfredLibrary/AUCI/chapter6/lesson2/trigapplication1pet.pg

A mass attached to a vertical spring has position function given by $s(t) = 4\sin(3t)$ where t is measured in seconds and s in inches.

(a) Find the velocity at time $t = 2$:

$v(2) =$ ______ in/s

(b) Find the acceleration at time $t = 2$:

$a(2) =$ ________ in/s^2

---

4. (1 pt) alfredLibrary/AUCI/chapter6/lesson2/implicit.pg
Suppose $\sin(x+y) = 4x - 4y$.

(a) Implicitly differentiate both sides of the equation above (enter y' for the derivative of y):

________ = ________

(b) Solve for y' to get $y' =$ ____________.

(c) The slope of the tangent line at the point (π, π) is ________.

(d) The equation of the tangent line at the point (π, π) is $y =$ ________.
(Hint: First write the point-slope form.)

---

5. (1 pt) alfredLibrary/AUCI/chapter6/lesson2/trigintegral29pet.pg
Use the Fundamental Theorem to evaluate each integral.

(a) $\int_0^4 (2e^x + 5\cos x)\,dx =$ ________ $\Big|_0^4 =$ ________

(b) $\int_{0.25}^{7.25} \sin\left(\frac{\pi}{3}x\right)\,dx =$ ________ $\Big|_{0.25}^{7.25} =$ ________

---

6. (1 pt) alfredLibrary/AUCI/chapter6/lesson2/quiz/triglimit1pet.pg
Consider $\lim_{t\to 0} \frac{\sin 2t}{\sin 7t}$.

Direct substitution yields the indeterminate form ________,

so we can use L'Hopital's rule to evaluate the limit.

It follows that, $\lim_{t\to 0} \frac{\sin 2t}{\sin 7t} =$ ________.

Homework 6.3 – Other Trigonometric Functions

1. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/quiz/question1.pg
Express the following trigonometric functions in terms of sine and cosine. You should memorize these formulas.

$\tan(x) = \dfrac{\_\_\_}{\_\_\_}$

$\cot(x) = \dfrac{\_\_\_}{\_\_\_}$

$\sec(x) = \dfrac{\_\_\_}{\_\_\_}$

$\csc(x) = \dfrac{\_\_\_}{\_\_\_}$

2. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/trigsimplify1pet.pg
Rewrite each expression as a single trigonometric function. (Hint: First rewrite each trig function in terms of sine and/or cosine.)

(a) $\tan(x)\cos(x) =$ ________

(b) $\dfrac{1}{\sin(x)\cos(x)} - \dfrac{1}{\tan(x)} =$ ________

3. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/trigquotient1pet.pg
If $h(x) = \dfrac{\cot(7x)}{\frac{1}{\sqrt{x^{13}}}}$, then $h(x) = \dfrac{f(x)}{g(x)}$ where

$f(x) =$ ________

and

$g(x) =$ ________.

By the quotient rule,

$h'(x) = \dfrac{\_\_\_\_\_\_ - \_\_\_\_\_\_}{\_\_\_\_\_\_}$

4. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/trigderiv6pet.pg
(a) If $f(x) = \tan x^2$, then $f'(x) =$ ________.

(b) If $g(x) = \tan^2 x$, then $g'(x) =$ ________.

5. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/lhopitals1pet.pg
(a) $\lim_{\theta\to 0} 7\sin(\theta) =$ ________

(b) $\lim_{\theta\to 0}(\theta + 4\tan(\theta)) =$ ________

(c) According to parts (a) and (b), we can use L'Hopital's rule on the following limit:

$$\lim_{\theta\to 0}\frac{7\sin(\theta)}{\theta + 4\tan(\theta)} = \lim_{\theta\to 0}\frac{\_\_\_\_\_\_}{\_\_\_\_\_\_}$$

(**Note:** Type 'theta' for θ.)

6. (1 pt) alfredLibrary/AUCI/chapter6/lesson3/trigintegral7pet.pg
Evaluate each integral.

(HINT for (a): You must first rewrite the integrand as a single trig function.)

(a) $\displaystyle\int \frac{1-\sin^2 x}{\cos x}\,dx =$ ________

(b) $\displaystyle\int_0^{\pi/12} \sec\theta\tan\theta\, d\theta =$ ________

(c) $\displaystyle\int \csc^2(4.5x+0.9)\,dx =$ ________

Homework 6.4 – Other Trigonometric Functions

1. (1 pt) **alfredLibrary/AUCI/chapter6/lesson4/quiz/question1.pg**
Evaluate the exact value of each limit. Decimal answers are not allowed. (Hint: look at the graph of $\tan^{-1}(x)$.)

(a) $\lim_{x\to+\infty} \tan^{-1}(x) =$ ___

(b) $\lim_{x\to-\infty} \tan^{-1}(x) =$ ___

2. (1 pt) **alfredLibrary/AUCI/chapter6/lesson4/inversetrigderiv2pet.pg**
Write your answers carefully on paper first! Also, note that g and h are compositions of three functions.

(a) If $f(x) = 2\sin(8x)\arcsin(x)$,

then $f'(x) =$ ______________________.

(b) If $g(x) = \tan^{-1}(\sin(2x))$,

then $g'(x) =$ ______________________.

(c) If $h(x) = \arcsin^3(2x+6)$,

then $h'(x) =$ ______________________

3. (1 pt) **alfredLibrary/AUCI/chapter6/lesson4/anti1.pg**
Evaluate the integral:
$\int_0^{0.8} \frac{dx}{\sqrt{1-x^2}} =$ ___ $\Big|_0^{0.8} =$ ______

4. (1 pt) **alfredLibrary/AUCI/chapter6/lesson4/anti2.pg**
Evaluate the integral:
$\int_1^{\sqrt{6}} \frac{9}{1+x^2}\,dx =$ ___ $\Big|_1^{\sqrt{6}} =$ __________

5. (1 pt) **alfredLibrary/AUCI/chapter6/review/anti1.pg**
Evaluate each integral without explicitly writing out the necessary substitution. In part (b), you will need to rewrite the integral by dividing each term by 5.

(a) $\int_0^{0.1} \frac{8}{\sqrt{1-(4x)^2}}\,dx =$ ________ $\Big|_0^{0.1} =$ __________

(b) $\int_1^{2} \frac{5}{5+x^2}\,dx =$ ________ $\Big|_1^{2} =$ __________

Homework 7.1 – Related Rates

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson1/relatedrates2pet.pg
A 24-ft conical water tank with a downward-pointing vertex has a radius of 10 ft at its top. If water flows into the tank at a rate of 20 cubic ft/min, how fast is the depth of the water increasing when the water is 16 ft deep?

(HINT: In your picture, let r be the radius of the surface of the water, let h be the height of the water, and let V be the volume of the water. You must find dh/dt when h is 16, but you do not know r and dr/dt when h is 16. Use similar triangles to find these quantities.)

Answer: __________ ft/min

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson1/relatedrates5pet.pg
A kite 50ft above the ground moves horizontally at a speed of 2ft/s. How fast is the angle between the string and the horizontal changing when 150ft of string has been let out?

Answer: ______________ radians/sec

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson1/relatedrates4pet.pg
A spotlight on the ground is shining on a wall 12m away. If a woman 2m tall walks from the spotlight toward the building at a speed of 1.2m/s, how fast is the length of her shadow on the building changing when she is 6m from the building? (HINT: Use similar triangles formed between the spotlight and the woman, and between the spotlight and the wall.)

Answer: ______________ m/s

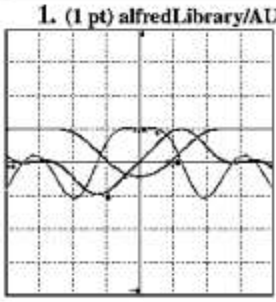
4. (1 pt) alfredLibrary/AUCI/chapter7/lesson1/relatedrates6pet.pg
When air expands adiabatically (without gaining or losing heat), its pressure P and volume V are related by the equation $PV^{1.4} = C$ where C is a constant. Suppose that at a certain instant, the volume is 330 cubic centimeters, and the pressure is 99 kPa and decreasing at a rate of 10 kPa/minute. At what rate is the volume increasing at this instant? (Hint: The left-hand side of the related variables equation is a product.)

Answer: ______________ cubic cm per min

(For your information, Pa stands for Pascal, which is equivalent to one Newton per square meter; kPa is a kiloPascal or 1000 Pascals.)

Homework 7.2 – Graph Analysis Using First and Second Derivatives

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson2/question1.pg



Identify the graphs A (blue), B (red) and C (green) as the graphs of a function and its derivatives:

___ is the graph of the function
___ is the graph of the function's first derivative
___ is the graph of the function's second derivative

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson2/graphanalysis5pet.pg

Let

$$f(x) = (9 - 6x)e^{x}.$$

Instructions:
If you are asked to find x- or y-values, enter either a number, a list of numbers separated by commas, or *None* if there aren't any solutions. Use **interval notation** if you are asked to find an interval or union of intervals, and enter { } if the interval is empty.

(a) Compute f' and perform sign tests to complete the following:

Critical numbers $x =$ ____________
Increasing on ____________
Decreasing on ____________
Local maxima $x =$ ____________
Local minima $x =$ ____________

(b) Compute f'' and perform sign tests to complete the following:

Concave up on ____________
Concave down on ____________
Inflection points $x =$ ____________

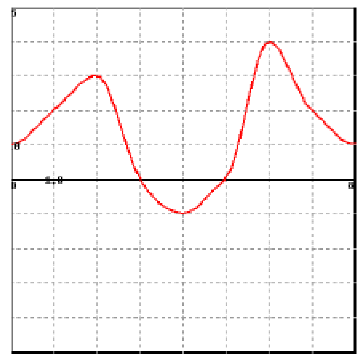
(c) Find any horizontal and vertical asymptotes of f.

Horizontal asymptotes $y =$ ____________
Vertical asymptotes $x =$ ____________

(d) Sketch a graph of the function f without a graphing calculator. Find and plot the y-intercept and the x-intercepts, if any. Draw dashed lines for horizontal and vertical asymptotes. Plot the points where f has local maxima, local minima, and inflection points. Use what you know from parts (a) and (b) to sketch the remaining parts of the graph of f.

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson2/question33.pg

Suppose $f(x)$ is a function. Below is the graph of the **DERIVATIVE** f' on the interval (0,8). This **IS NOT** the graph of f.



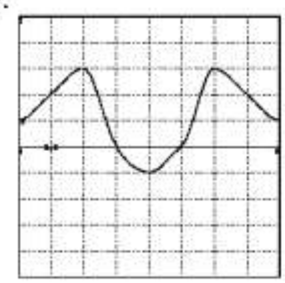
Refer to the graph to answer each of the following questions. For part (a), use **interval notation** to report your answer.

(a) For which values of x in (0,8) is f increasing? (If the function is not increasing anywhere, then enter (empty braces).)
Increasing on ____________

(b) Find all values of x in (0,8) at which f has a local minimum, and list them (separated by commas) in the box below. (If there are no local minima, then enter *none* .)
Local minima at $x =$ ____________

4. (1 pt) alfredLibrary/AUCI/chapter7/lesson2/question44.pg

Suppose $f(x)$ is a function. Below is the graph of the **DERIVATIVE** f' on the interval (0,8). This **IS NOT** the graph of f.



Refer to the graph to answer each of the following questions. For part (a), use **interval notation** to report your answer.

(a) For which values of x in (0,8) is f concave down? (If the function is not concave down anywhere, then enter *none* .)
Concave down on ____________

(b) Find all values of x in (0,8) where f has an inflection point, and list them (separated by commas) in the box below. (If there are no inflection points, then enter *none* .)
Inflection Points at $x =$ ____________

Homework 7.3 – Graph Analysis with the TI-84

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/expreg1pet.pg
(a) Enter the data below into your graphing calculator and view the scatter plot. Conclude that the data is exponential.

t	y
0	16.8218
4	34.8934
8	71.968
12	146.241
16	302.138
20	625.15
24	1279.62

(b) Use your calculator to find an exponential model for the data.

$y(t) =$ ______

(c) Graph your model over the scatter plot. Is it a good fit?

(d) Use the options under the "calculate" menu to find the rate of change of your model at $t = 12$.

$y'(12) =$ ______

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/zeros1pet.pg
Use your graphing calculator to approximate to two decimal places the real solutions to the equation

$$x^4 + 0.24x^3 + 3.9055x^2 + 0.96x - 0.378 = 0.$$

$x =$ ______

Note: If there is more than one solution, enter them as a comma-separated list.

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/increasedecrease1pet.pg
Consider the function

$$f(x) = -10x^3 + 45x^2 + 1620x + 6$$

Use your graphing calculator to find the critical points of f, then fill in the following information:

(a) The graph of f is increasing on the open interval (___ , ___).

(b) The graph of f is decreasing on the open interval ($-\infty$, ___) and the open interval interval (___, ∞).

(c) The graph of f has a local maximum at $x =$ ___.

4. (1 pt) alfredLibrary/AUCI/chapter7/lesson3/graph1pet.pg
Suppose that

$$f(x) = 9x^2 \ln(x), \quad x > 0.$$

Use the appropriate options under the "calculate" menu of your graphing calculator to determine the following information.

(a) List the x-values of all critical points of f. If there are no critical points, enter 'NONE'.

Critical points = ___

(b) List the x-coordinates of all local maxima of f. If there are no local maxima, enter 'NONE'.

x-values of local maxima = ___

(c) List the x-coordinates of all local minima of f. If there are no local minima, enter 'NONE'.

x-values of local minima = ___

(d) Use interval notation to indicate where f is increasing.

Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.

Increasing: ______

(e) Use interval notation to indicate where f is decreasing.

Decreasing: ______

For the next three parts, find $f'(x)$ and graph it on your calculator.

(f) List the x-values of all inflection points of f. If there are no inflection points, enter 'NONE'.

x-values of inflection points = ___

(g) Use interval notation to indicate where f is concave up.

Concave up: ______

(h) Use interval notation to indicate where f is concave down.

Concave down: ______

Homework 7.4 – The Extreme Value Theorem and Optimization

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/EVT2pet.pg
Use the Extreme Value Theorem to find the absolute maximum and absolute minimum values of $f(t) = t\sqrt{9-t^2}$ on the interval $[-3,3]$. Your answers should be the maximum and minimum function values, not the t-values.

Absolute maximum is ________.

Absolute minimum is ________.

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/optimization2pet.pg
A rancher wants to fence in an area of 500000 square feet in a rectangular field and then divide it in half with a fence down the middle parallel to one side. What is the minimum amount of fencing needed to complete this task?

Minimum amount of fencing = ____________ ft

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/optimization3pet.pg
If 432cm^2 of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

Largest volume = ____________ cm^3

4. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/optimization4pet.pg
A fence is to be built to enclose a rectangular area of 270 square feet. The fence along three sides is to be made of material that costs 4 dollars per foot, and the material along the fourth side costs 12 dollars per foot. Find the length and width of the enclosure that is most economical to construct.

Length = ____ ft

Width = ____ ft

5. (1 pt) alfredLibrary/AUCI/chapter7/lesson4/quiz-/optimization2pet.pg
A box is to be made out of a 8 cm by 20 cm piece of cardboard. Squares of side length x cm will be cut out of each corner, and then the ends and sides will be folded up to form a box with an open top.

(a) Draw a labeled sketch.

(b) Express the volume V of the box as a function of x.

$V(x) =$ ____________________ cm^3

(c) Give the domain of V in interval notation.

Domain = ________________

(d) Find the length L, width W, and height x of the resulting box that maximizes the volume. (Assume that $W \leq L$. That is, assume that the width W of the box is the side formed from the shorter side of cardboard, and the length L of the box is the side formed from the longer side.)

$L =$ ________ cm

$W =$ ________ cm

$x =$ ________ cm

(e) Find the maximum volume of the box.

Maximum volume = ____________ cm^3.

Homework 7.5 – Differential Equations

1. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/checksolution1.pg
If $y(t) = 4\cos(5t)$,

then $y'(t) =$ ________,

and $y''(t) =$ ________.

Therefore, y satisfies which of the following differential equations? Check all that apply.

- A. $y' = 5y$
- B. $y' = -5y$
- C. $y'' = 25y$
- D. $y'' = -25y$

2. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/checksolution2.pg
If $y(t) = 6e^{5t}$,

then $y'(t) =$ ________,

and $y''(t) =$ ________.

Therefore, y satisfies which of the following differential equations? Check all that apply.

- A. $y' = 5y$
- B. $y' = -5y$
- C. $y'' = 25y$
- D. $y'' = -25y$

3. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/simplemodel1pet.pg
The knowledge K (measured in volumes of research published) that a civilization can amass per year is proportional to the knowledge it currently possesses. Suppose that this civilization can continuously add 7

$$K' = \_\_\_K, \text{ where } K(0) = \_\_\_.$$

The solution to this problem is $K(t) =$ ________.

4. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/newtonslaw5pet.pg
A cup of coffee at 193 degrees is poured into a mug and left in a room at 75 degrees. After 7 minutes, the coffee is 142 degrees. In this example, the differential equation describing Newton's Law of Cooling is $\frac{dT}{dt} = -k(T-75)$. Solve this differential equation (i.e., find a formula for $T(t)$) and answer the following questions.

(a) What is the temperature of the coffee after 17 minutes?

$T(17) =$ ____________ degrees

(b) After how many minutes will the coffee be 100 degrees?

$t =$ ____________ minutes

5. (1 pt) alfredLibrary/AUCI/chapter7/lesson5/spring1pet.pg
A weight is attached to a horizontal spring that satisfies the differential equation

$$x'' = -0.01x$$

The units for x are centimeters, and the units for the independent variable t are seconds. Consider a "stretch" in the spring as a positive quantity, and a "compression" as a negative one.

Initially the spring is stretching at a rate of 5 cm/sec and is stretched 5 cm from equilibrium.

(a) Write the formula for the location of the weight at time t.

$x(t) =$ ________ cm

(b) Find the location of the weight 9 seconds after it is set in motion.

$x(9) =$ ________ cm

Homework 8.1 – Sigma Notation and Summations

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson1/quiz/sum4pet.pg
Find the numerical value of each sum without using the "summation formulas."

(a) $\sum_{k=2}^{7}(3k-1) =$ ______

(b) $\sum_{k=4}^{7}(k^2-k) =$ ______

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson1/sum6pet.pg
Use the "summation formulas" to express the following sum in closed form. Your answer should be in terms of n.

$\sum_{k=1}^{n}(2+2k)^2 =$ ______

(HINT: You must first expand $(2+2k)^2$).

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson1/sum8pet.pg
(a) Use the "summation formulas" to find a closed form for the sum. Your answer will be in terms of n.

$\sum_{k=1}^{n}(7-6k+k^2+6k^3) =$ ______

(b) Use the closed form from part (a) to find the sum.

$\sum_{k=1}^{25}(7-6k+k^2+6k^3) =$ ______

4. (1 pt) alfredLibrary/AUCI/chapter8/lesson1/sum2pet.pg
Use the "summation formulas" to express the following sum in closed form. Your answer should be in terms of n.

$\sum_{k=1}^{n}\left(2+3\cdot\frac{k}{n}\right)^2 =$ ______

(HINT: You must first expand $\left(2+3\cdot\frac{k}{n}\right)^2$).

Homework 8.2 – The Definition of Net Area

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson2/defintegral9pet.pg

In this problem you will calculate $\int_1^3 5x\,dx$ by using the formal definition of the definite integral:

$$\int_a^b f(x)\,dx = \lim_{n\to\infty}\left[\sum_{k=1}^{n} f(x_k^*)\Delta x\right].$$

(a) The interval $[1,3]$ is divided into n equal subintervals of length Δx. What is Δx (in terms of n)?

$\Delta x =$ ________________

(b) The right-hand endpoint of the kth subinterval is denoted x_k^*. What is x_k^* (in terms of k and n)?

$x_k^* =$ ________________

(c) Using these choices for x_k^* and Δx, the definition tells us that

$$\int_1^3 5x\,dx = \lim_{n\to\infty}\left[\sum_{k=1}^{n} f(x_k^*)\Delta x\right].$$

What is $f(x_k^*)\Delta x$ (in terms of k and n)?

$f(x_k^*)\Delta x =$ ________________

(d) Express $\sum_{k=1}^{n} f(x_k^*)\Delta x$ in closed form. (Your answer will be in terms of n.)

$\sum_{k=1}^{n} f(x_k^*)\Delta x =$ ________________

(e) Finally, complete the problem by taking the limit as $n\to\infty$ of the expression that you found in the previous part.

$$\int_1^3 5x\,dx = \lim_{n\to\infty}\left[\sum_{k=1}^{n} f(x_k^*)\Delta x\right] = \_\_\_\_\_\_\_\_$$

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson2/right1pet.pg

In this problem you will calculate $\int_0^3 x^2+3\,dx$ by using the formal definition of the definite integral:

$$\int_a^b f(x)\,dx = \lim_{n\to\infty}\left[\sum_{k=1}^{n} f(x_k^*)\Delta x\right].$$

(a) The interval $[0,3]$ is divided into n equal subintervals of length Δx. What is Δx (in terms of n)?

$\Delta x =$ ________________

(b) The right-hand endpoint of the kth subinterval is denoted x_k^*. What is x_k^* (in terms of k and n)?

$x_k^* =$ ________________

(c) Using these choices for x_k^* and Δx, the definition tells us that

$$\int_0^3 x^2+3\,dx = \lim_{n\to\infty}\left[\sum_{k=1}^{n} f(x_k^*)\Delta x\right].$$

What is $f(x_k^*)\Delta x$ (in terms of k and n)?

$f(x_k^*)\Delta x =$ ________________

(d) Express $\sum_{k=1}^{n} f(x_k^*)\Delta x$ in closed form. (Your answer will be in terms of n.)

$\sum_{k=1}^{n} f(x_k^*)\Delta x =$ ________________

(e) Finally, complete the problem by taking the limit as $n\to\infty$ of the expression that you found in the previous part.

$$\int_0^3 x^2+3\,dx = \lim_{n\to\infty}\left[\sum_{k=1}^{n} f(x_k^*)\Delta x\right] = \_\_\_\_\_\_\_\_$$

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson2/absval11pet.pg

Use the properties of the definite integral to evaluate the integral.

$$\int_0^{10} |x^2-5x|\,dx = \_\_\_\_\_\_\_\_\_\_\_\_$$

4. (1 pt) alfredLibrary/AUCI/chapter8/review/props6pet.pg

(a) If $\int_3^9 f(x)dx = -53$, then $\int_9^3 f(x)dx =$ _____

(b) If $\int_1^7 g(x)\,dx = 12$ and $\int_6^7 g(x)\,dx = 3.3$, then $\int_1^6 g(x)\,dx =$ _____

(c) If $\int_5^{11} h(x)\,dx = 3$, $\int_5^7 h(x)\,dx = 2$, and $\int_9^{11} h(x)\,dx = 2$, then $\int_9^7 3h(x) - 2\,dx =$ _____

Homework 8.3 – Rolle's Theorem and the Mean Value Theorem

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson3/MVT3pet.pg

Consider the function $f(x) = 4x^3 - 4x$ on the interval $[-5,5]$. Find the average or mean slope of the function on this interval:

$$\frac{f(5)-f(-5)}{5-(-5)} = \_\_\_\_\_\_\_\_$$

By the Mean Value Theorem, we know there exists at least one c in the open interval $(-5,5)$ such that $f'(c)$ is equal to this average slope. For this problem, there are two values of c that work.

The smaller one is $c =$ ________,

and the larger one is $c =$ ________.

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson3/quiz/MVT2pet.pg

Consider the function $f(x) = \frac{1}{x}$ on the interval $[3,9]$. Find the average or mean slope of the function on this interval:

$$\frac{f(9)-f(3)}{9-(3)} = \_\_\_\_\_\_\_\_$$

By the Mean Value Theorem, we know there exists a c in the open interval $(3,9)$ such that $f'(c)$ is equal to this average slope. For this problem, there is only one c that works. Find it.

$c =$ ________

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson3/continuity1pet.pg

For each function, decide whether it is continuous on the given closed interval by answering "y" for yes or "n" for no. Note that you only have 2 attempts for this problem.

(a) $f(x) = x^3 - x^2 + x$ on $[1,10]$: ____

(b) $f(x) = \frac{x-1}{x-2}$ on $[-3,1]$: ____

(c) $f(x) = \frac{x+1}{x+3}$ on $[-3,5]$: ____

(d) $f(x) = |x^2 - 4|$ on $[0,4]$: ____

4. (1 pt) alfredLibrary/AUCI/chapter8/lesson3/diff1pet.pg

For each function, decide whether it is differentiable on the given closed interval by answering "y" for yes or "n" for no. Note that you only have 2 attempts for this problem.

(a) $f(x) = x^3 - x^2 + x$ on $[1,10]$: ____

(b) $f(x) = \frac{x-1}{x-2}$ on $[-3,1]$: ____

(c) $f(x) = \frac{x+1}{x+3}$ on $[-3,5]$: ____

(d) $f(x) = |x^2 - 4|$ on $[0,4]$: ____

Homework 8.4 – The Fundamental Theorem of Calculus (Part 1)

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson4/FTC3pet.pg
Evaluate the definite integral if possible. Otherwise, type "improper" if the integral is improper.

$$\int_{-5}^{5} \frac{8}{x^3}\,dx = \_\_\_\_\_\_\_\_\_\_\_\_$$

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson4/FTC4pet.pg
Evaluate the definite integral if possible. Otherwise, type "improper" if the integral is improper.

$$\int_{1}^{6} 5+\frac{1}{x}+\frac{1}{x^2}\,dx = \_\_\_\_\_\_\_\_\_\_\_\_$$

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson4/FTC5pet.pg
Evaluate the definite integral if possible. Otherwise, type "improper" if the integral is improper.

$$\int_{-1}^{1} e^{3x}\,dx = \_\_\_\_\_\_\_\_\_\_\_\_$$

4. (1 pt) alfredLibrary/AUCI/chapter8/lesson4/FTC6pet.pg
Evaluate the definite integral if possible. Otherwise, type "improper" if the integral is improper.

$$\int_{0}^{\pi} 2\sin(x)\,dx = \_\_\_\_\_\_\_\_\_\_\_\_$$

5. (1 pt) alfredLibrary/AUCI/chapter8/lesson4/quiz/FTC4pet.pg
Use Part 1 of the Fundamental Theorem of Calculus to evaluate the definite integral.

$$\int_{0}^{0.4} \frac{dx}{\sqrt{1-x^2}} = \_\_\_\_\_\_\_\_\_\_\_\_$$

Homework 8.5 – The Fundamental Theorem of Calculus (Part 2)

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson5/quiz/FTCpart21pet.pg

Let $f(x) = \int_3^x \frac{t^6}{e^t+2}\,dt$.

By Part 2 of the Fundamental Theorem of Calculus,

$f'(x) =$ ________,

and

$f'(2) =$ ________.

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson5/FTC8pet.pg

Suppose $f(x) = \int_0^x \frac{t^2-25}{4+\cos^2(t)}\,dt$.

For what value(s) of x does $f(x)$ have a local maximum? Enter a number, a list of numbers separated by commas, or *NONE*.

(HINT: Use Part 2 of the FTC to find $f'(x)$. Then perform a sign test.)

$x =$ ________

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson5/FTC9pet.pg

Use Part 2 of the Fundamental Theorem of Calculus to find the derivative of

$$F(x) = \int_{3x}^{3} \sin\left(t^4\right)\,dt.$$

$F'(x) =$ ________

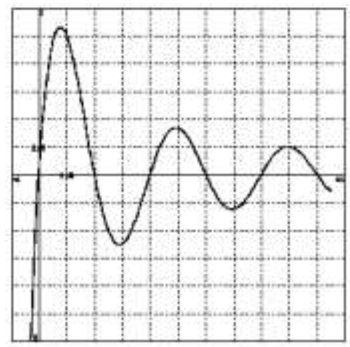
4. (1 pt) alfredLibrary/AUCI/chapter8/lesson5/FTC10pet.pg

If $f(x) = \int_1^{x^3} \sqrt{t^2+9}\,dt$,

then $f'(x) =$ ________.

5. (1 pt) alfredLibrary/AUCI/chapter8/lesson5/graphical.pg

Let $g(x) = \int_0^x f(t)\,dt$, where f is the function whose graph is shown. Answer the following questions only on the interval $[0, 10]$. Enter multiple answers as a comma-separated list. Click on the graph to enlarge the image.



(a) At what value(s) of x does g have a local maximum?

$x =$ ________

(b) At what value(s) of x does g have a local minimum?

$x =$ ________

(c) At what value(s) of x does g have an absolute maximum?

$x =$ ________

Homework 8.6 – Integration by Substitution

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson6/indefiniteusub5.pg
For the indefinite integral

$$\int x^2 e^{x^3}\, dx,$$

a good choice for a u -substitution is

$u =$ __________

$du =$ __________

After making the substitution into the integral, we have

$\int$ __________ $=$ __________.

Therefore, $\int x^2 e^{x^3}\, dx =$ __________.

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson6/quiz-/indefiniteusub33pet.pg
For the indefinite integral

$$\int \frac{x+5}{x^2+10x+26}\, dx,$$

a good choice for a u -substitution is

$u =$ __________

$du =$ __________

After making the substitution into the integral, we have

$\int$ __________ $=$ __________.

Therefore, $\int \frac{x+5}{x^2+10x+26}\, dx =$ __________.

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson6/definiteusub7.pg
Consider the definite integral $\int_2^5 (2x-2)^2\, dx$.

Then the most appropriate substitution to simplify this integral is

$u =$ __________

$du =$ __________

After making the substitution, changing the limits of integration, and simplifying, we obtain

$\int_2^5 (2x-2)^2\, dx =$ __ $\int$__ ______ $=$ ______ $\Big|$ __

4. (1 pt) alfredLibrary/AUCI/chapter8/lesson6/definiteusub6.pg
Consider the definite integral $\int_1^4 x^2 (2+3x^3)^3\, dx$.

Then the most appropriate substitution to simplify this integral is

$u =$ __________

$du =$ __________

After making the substitution, changing the limits of integration, and simplifying, we obtain

$\int_1^4 x^2 (2+3x^3)^3\, dx =$ __ $\int$__ ______ $=$ ______ $\Big|$

5. (1 pt) alfredLibrary/AUCI/chapter8/lesson6/definiteusub34pet.pg
Evaluate the definite integral using an appropriate u-substitution.

$\int_0^{\pi/2} e^{\sin(7x)} \cos(7x) dx =$ ______________

Homework 8.7 – Modeling Accumulated Change with the TI-84

1. (1 pt) alfredLibrary/AUCI/chapter8/lesson7/calc1pet.pg
A particle that moves along a straight line has velocity

$$v(t) = 250t^2e^{-4t}$$

meters per second after t seconds. How many meters will it travel during the first 8 seconds?

Answer: ______ meters

2. (1 pt) alfredLibrary/AUCI/chapter8/lesson7/calc3pet.pg
Use your calculator to compute the integral.

$$\int_{-1}^{5} |10x^2 - x^3 - 16x|\, dx = \_\_\_\_\_\_$$

3. (1 pt) alfredLibrary/AUCI/chapter8/lesson7/calc2pet.pg
Suppose that the density of cars (in cars per mile) along the northernmost 20-mile stretch of the Garden State Parkway is approximated by $\delta(x) = 125\left(2 + \sin\left(4\sqrt{x + 0.175}\right)\right)$, where x is the number of miles from the New York border. Find the total number of cars on the 20-mile stretch.

Answer: ________ cars

4. (1 pt) alfredLibrary/AUCI/chapter8/lesson7/calculator1pet.pg
View a scatter plot of the following data set and observe that it exhibits cubic behavior:

t	$y = a_3t^3 + a_2t^2 + a_1t + a_0$
0	5.853
0.5	9.87456
1	11.4935
1.5	11.2644
2	10.1606
2.5	8.6938
3	7.60536
3.5	7.74682
4	9.84068

(NOTE: Round all numbers in your answers to four decimal places.)

(a) Find a cubic regression model for the data: ____________

(b) Find the critical points of the model: ________

(c) The local maximum of the model on the interval $[0,4]$ is ______

(d) The local minimum for of the model on the interval $[0,4]$ is ______

(e) Find the net change in the data on the interval $[0,4]$ by integrating the regression model: ______