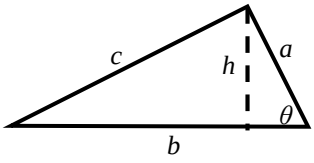
APPENDIX A

QUICK REFERENCE

GEOMETRY FORMULAS

Triangle

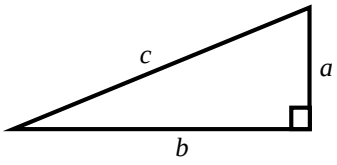


Area = $\frac{1}{2}bh$

Law of Cosines:
$c^2 = a^2 + b^2 - 2ab\cos\theta$

Height = $h = a\sin\theta$

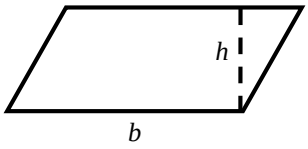
Right Triangle



Area = $\frac{1}{2}ba$

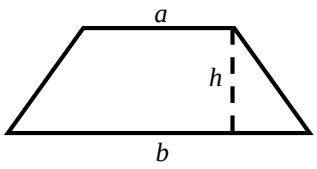
Pythagorean Thm:
$c^2 = a^2 + b^2$

Parallelogram



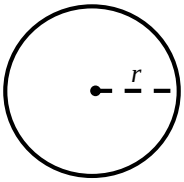
Area = bh

Trapezoid



Area = $\frac{1}{2}(a+b)h$

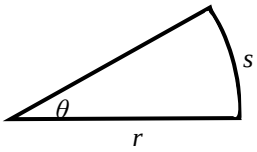
Circle



Area = πr^2

Circumference = $2\pi r$

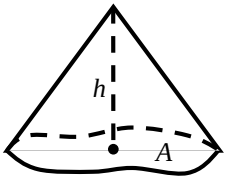
Sector of a Circle



Area = $\frac{1}{2}\theta r^2$

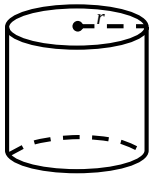
Arc = $s = r\theta$

Cone



Volume = $\frac{1}{3}Ah$

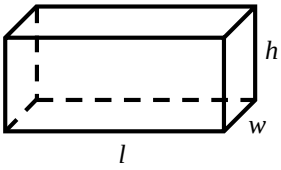
Right Circular Cylinder



Volume = $\pi r^2 h$

Lateral Surface = $2\pi rh$

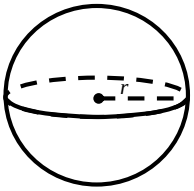
Rectangular Solid



Volume = lwh

Surface Area =
$2lw + 2lh + 2wh$

Sphere

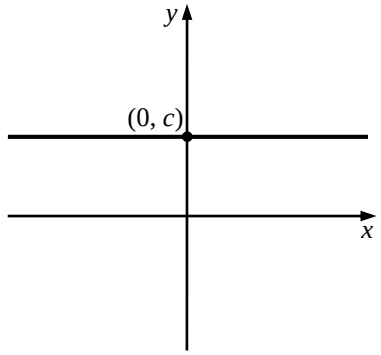


Volume = $\frac{4}{3}\pi r^3$

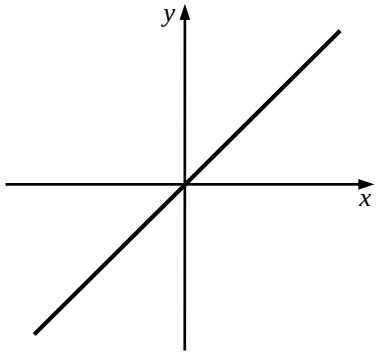
Surface Area = $4\pi r^2$

GRAPHS OF COMMON FUNCTIONS

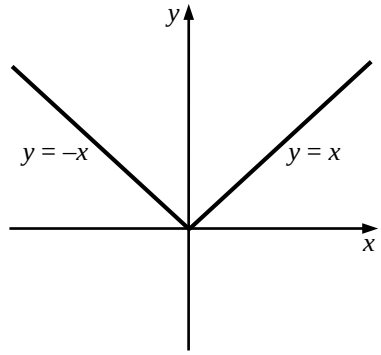
Constant $y = c$



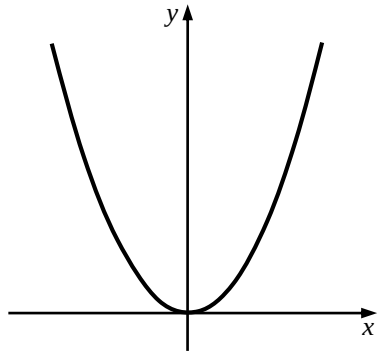
Linear $y = x$



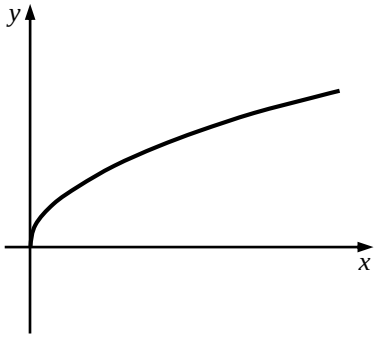
Absolute Value $y = |x|$



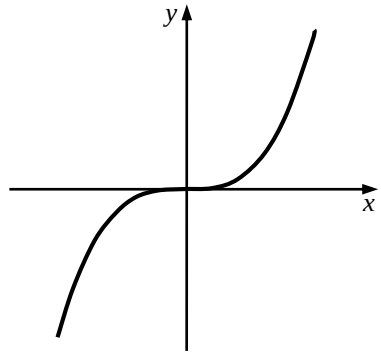
Quadratic $y = x^2$



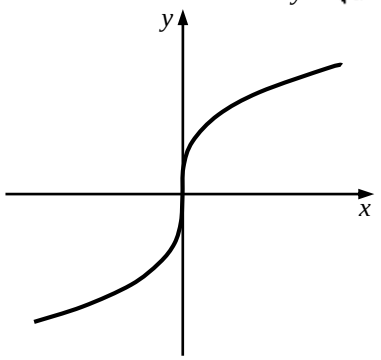
Square Root $y = \sqrt{x}$



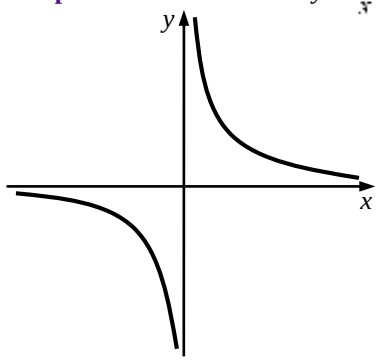
Cubic $y = x^3$



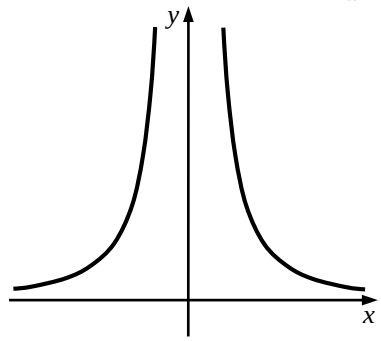
Cube Root $y = \sqrt[3]{x}$



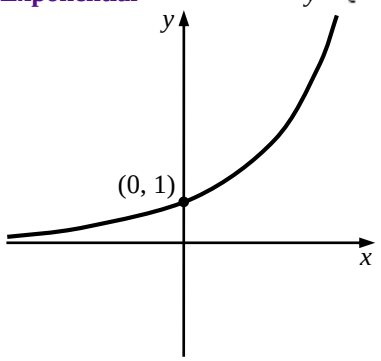
Reciprocal $y = \frac{1}{x}$



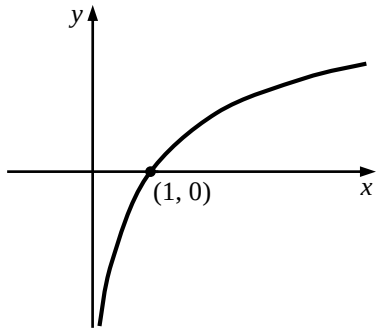
Reciprocal Squared $y = \frac{1}{x^2}$



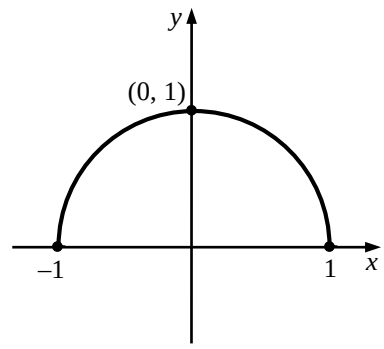
Exponential $y = e^x$



Logarithm $y = \ln x$

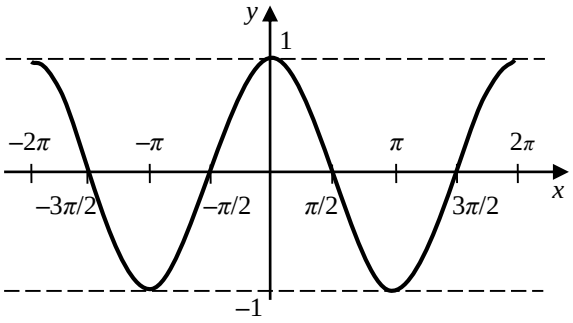


Semi-Circle $y = \sqrt{1 - x^2}$

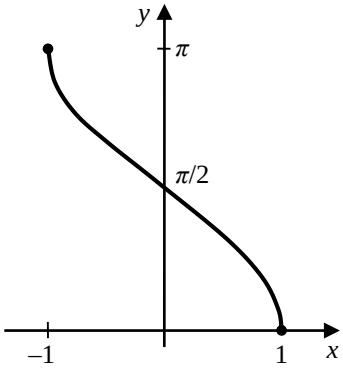


GRAPHS OF TRIGONOMETRIC FUNCTIONS AND THEIR INVERSES

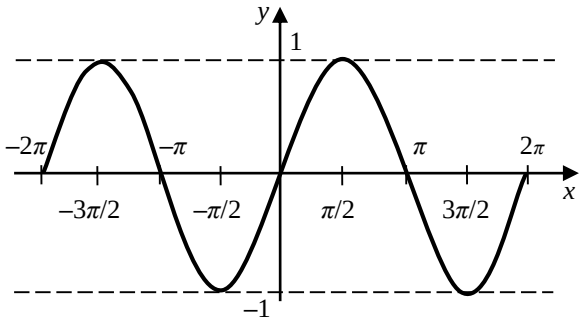
Cosine $y = \cos x$



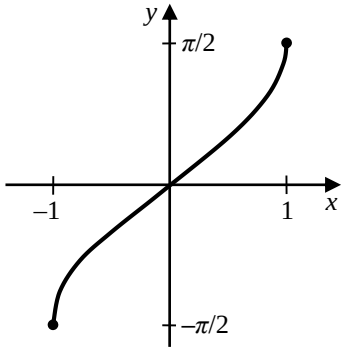
Arccosine $y = \cos^{-1}x$



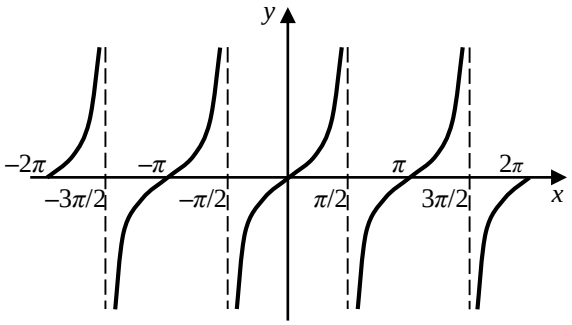
Sine $y = \sin x$



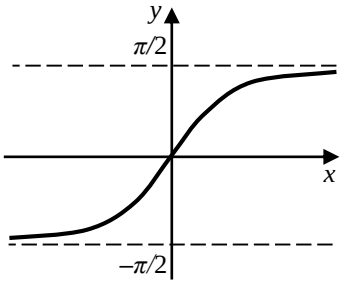
Arcsine $y = \sin^{-1}x$



Tangent $y = \tan x$



Arctangent $y = \tan^{-1}x$



PRECALCULUS CONCEPTS AND FORMULAS

Average rate of change in y on the interval $[x_0, x_1]$: $\dfrac{\Delta y}{\Delta x} = \dfrac{f(x_1) - f(x_0)}{x_1 - x_0}$

Slope of the line between any two points (x_1, y_1) and (x_2, y_2): $m = \dfrac{\Delta y}{\Delta x} = \dfrac{y_2 - y_1}{x_2 - x_1}$

Slope-intercept form: $y = mx + b$, where m is the slope and b is the y-intercept

Point-slope form: $y - y_0 = m(x - x_0)$, where m is the slope and (x_0, y_0) is a point on the line

Quadratic formula: If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Special forms: Difference of squares: $x^2 - a^2 = (x + a)(x - a)$

Sum of squares: $x^2 + a^2$ Never factors over the reals.

Difference of cubes: $x^3 - a^3 = (x - a)(x^2 + ax + a^2)$

Sum of cubes: $x^3 + a^3 = (x + a)(x^2 - ax + a^2)$

Properties of exponents:

$$x^m x^n = x^{m+n} \qquad \left(x^m\right)^n = x^{mn} \qquad x^{-n} = \frac{1}{x^n} \qquad x^{m/n} = \sqrt[n]{x^m} = \left(\sqrt[n]{x}\right)^m$$

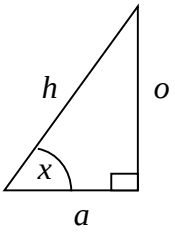
Inverse and algebraic properties:

$$\log_b(b^x) = x \text{ and } b^{\log_b x} = x \qquad \ln(e^x) = x \text{ and } e^{\ln x} = x$$
$$\log_b(x \cdot y) = \log_b x + \log_b y \qquad \ln(x \cdot y) = \ln x + \ln y$$
$$\log_b(x / y) = \log_b x - \log_b y \qquad \ln(x / y) = \ln x - \ln y$$
$$\log_b(x^y) = y \cdot \log_b x \qquad \ln(x^y) = y \cdot \ln x$$
$$\log_b(\sqrt[y]{x}) = \frac{\log_b x}{y} \qquad \ln(\sqrt[y]{x}) = \frac{\ln x}{y}$$

Exponential change of base: $b^x = a^{(\log_a b)x}$ $\qquad b^x = e^{(\ln b)x}$

Logarithmic change of base: $\log_b x = \dfrac{\log_a x}{\log_a b}$ $\qquad \log_b x = \dfrac{\ln x}{\ln b}$

Right triangle trigonometry: Pythagorean theorem: $a^2 + o^2 = h^2$



$$\cos x = \frac{a}{h} \qquad \sin x = \frac{o}{h} \qquad \tan x = \frac{o}{a} = \frac{\sin x}{\cos x}$$
$$\sec x = \frac{h}{a} = \frac{1}{\cos x} \qquad \csc x = \frac{h}{o} = \frac{1}{\sin x} \qquad \cot x = \frac{a}{o} = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$$

DERIVATIVE AND INTEGRAL FORMULAS

Assume *a*, *b*, *c*, *k*, *m* and *n* are constants and *f* and *g* are differentiable/integrable functions.

Differentiation Rules/Formulas/Properties:

1. Limit Definition: $f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$
2. Constant: $\frac{d}{dx}(c) = 0$
3. Linear: $\frac{d}{dx}(mx+b) = m$
4. Power: $\frac{d}{dx}\left(x^n\right) = nx^{n-1}$
5. Reciprocal: $\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$
6. Square Root: $\frac{d}{dx}\left(\sqrt{x}\right) = \frac{1}{2\sqrt{x}}$
7. Constant Multiple: $\frac{d}{dx}\left(k \cdot f(x)\right) = k \cdot f'(x)$
8. Sum/Difference: $\frac{d}{dx}\left(f(x) \pm g(x)\right) = f'(x) \pm g'(x)$
9. Product: $\frac{d}{dx}\left(f(x) \cdot g(x)\right) = f'(x) \cdot g(x) + f(x) \cdot g'(x)$
10. Quotient: $\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{\left(g(x)\right)^2}$
11. Chain: $\frac{d}{dx}\left(f(g(x))\right) = f'(g(x)) \cdot g'(x)$
12. Sine: $\frac{d}{dx}(\sin x) = \cos x$
13. Cosine: $\frac{d}{dx}(\cos x) = -\sin x$
14. Tangent: $\frac{d}{dx}(\tan x) = \sec^2 x$
15. Cotangent: $\frac{d}{dx}(\cot x) = -\csc^2 x$
16. Secant: $\frac{d}{dx}(\sec x) = \sec x \tan x$
17. Cosecant: $\frac{d}{dx}(\csc x) = -\csc x \cot x$
18. Logarithm: $\frac{d}{dx}(\ln x) = \frac{1}{x}$
19. Exponential: $\frac{d}{dx}\left(e^x\right) = e^x$
20. Arcsine: $\frac{d}{dx}\left(\sin^{-1} x\right) = \frac{1}{\sqrt{1-x^2}}$
21. Arccosine: $\frac{d}{dx}\left(\cos^{-1} x\right) = \frac{-1}{\sqrt{1-x^2}}$
22. Arctangent: $\frac{d}{dx}\left(\tan^{-1} x\right) = \frac{1}{1+x^2}$

Indefinite Integration Rules/Formulas/Properties:

1. $\int m\,du = mx + C$
2. $\int x^n dx = \frac{1}{n+1}x^{n+1} + C$, if $n \neq -1$
3. $\int \sin x\,dx = -\cos x + C$
4. $\int \cos x\,dx = \sin x + C$
5. $\int \sec^2 x\,dx = \tan x + C$
6. $\int \csc^2 x\,dx = -\cot x + C$
7. $\int \sec x \tan x\,dx = \sec x + C$
8. $\int \csc x \cot x\,dx = -\csc x + C$
9. $\int e^x\,dx = e^x + C$
10. $\int \frac{1}{x}\,dx = \ln|x| + C$
11. $\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1} x + C$
12. $\int \frac{-1}{\sqrt{1-x^2}}\,dx = \cos^{-1} x + C$
13. $\int \frac{1}{1+x^2}\,dx = \tan^{-1} x + C$
14. $\int k \cdot f(x)\,dx = k \cdot \int f(x)\,dx$
15. $\int \big(f(x) \pm g(x)\big)du = \int f(x)dx \pm \int g(x)dx$

Definite Integration Rules/Formulas/Properties:

1. Limit Definition: $\int_a^b f(x)\,dx = \lim_{n\to\infty} \sum_{k=1}^{n} f(x_k^*)\Delta x$, where $\Delta x = \frac{b-a}{n}$
2. Same Limits of Integration: $\int_a^a f(x)\,dx = 0$
3. Switching Limits of Integration: $\int_b^a f(x)\,dx = -\int_a^b f(x)\,dx$
4. Combining Intervals of Integration: $\int_a^c f(x)dx + \int_c^b f(x)dx = \int_a^b f(x)dx$
5. Fundamental Theorem of Calculus (Part 1): $\int_a^b F'(x)\,dx = F(b) - F(a)$
6. Fundamental Theorem of Calculus (Part 2): $\frac{d}{dx}\left(\int_a^x f(t)\,dt\right) = f(x)$