[redacted].

1. If $\lim_{x\to a} f(x)$ and $\lim_{x\to a} g(x)$ ______, then
a. _______________ $= \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x)$
b. _______________ $= c\lim_{x\to a} f(x) \lim_{x\to a} g(x)$
c. _______________ $= \lim_{x\to a} f(x) / \lim_{x\to a} g(x)$ provided $\lim_{x\to a} g(x)$ _______
d. $\lim_{x\to a}(f(x))^n =$ _______ if n is a positive integer.
e. $\lim_{x\to a}(f(x))^{1/n} =$ _______ if n is a positive integer (if n is even then $\lim_{x\to a} f(x) > 0$).
f. $\lim_{x\to a} c =$ _______
g. $\lim_{x\to a} x^n =$ _______ where n is a positive integer.
h. $\lim_{x\to 0} \frac{\sin x}{x} =$ _______
key: exist, $\lim_{x\to a}(f(x) \pm g(x))$, $\lim_{x\to a} c(f(x)g(x))$, $\lim_{x\to a}(f(x)/g(x))$, $\neq 0$. $[\lim_{x\to a} f(x)]^n$, $[\lim_{x\to a} f(x)]^{1/n}$, c, a^n, 1,
2. (a.) If $f(x)$_______$g(x)$ for x ______, then $\lim_{x\to a} f(x) \le \lim_{x\to a} g(x)$, provided the limits exist. **key:** $\le$, near a
(b) if $f(x) \le g(x) \le h(x)$ for x ______, and $\lim_{x\to a} f(x) = L = \lim_{x\to a} h(x)$, then $\lim_{x\to a} g(x) =$ ___
key: near a , L
3. $f(x)$ is continuous at a if $\lim_{x\to a^-} f(x)$ ______ $\lim_{x\to a^+} f(x)$.
If f and g are ________, then so are $f \pm g$, fg and f/g (provided $g(x)$ ___)
polynomial, rational, root and trigonometric functions are continuous ________.
key: $= f(a) =$, continuous at a , $\neq 0$, in their domain ,
4. $f'(x) = \lim_{h\to 0}$ __________
key: $\frac{f(x+h)-f(x)}{h}$
5. $(cf(x) \pm g(x))' =$ _____________ **key:** $cf'(x) \pm g'(x)$
6. $(f(x)g(x))' =$ _____________ **key:** $f'(x)g(x) + f(x)g'(x)$
7. $(f(x)/g(x))' =$ _____________ **key:** $\frac{f'(x)g(x)-f(x)g'(x)}{(g(x))^2}$
8. (1) $(x^n)' =$ _____________ **key:** nx^{n-1}
(2) $(\sin x)' =$ _____________ **key:** $\cos x$
(3) $(\cos x)' =$ _____________ **key:** $-\sin x$
(4) $(\tan x)' =$ _____________ **key:** $\sec^2 x$
(5) $(\sec x)' =$ _____________ **key:** $\sec x \tan x$
(6) $(\cot x)' =$ _____________ **key:** $-\csc^2 x$
(7) $(\csc x)' =$ _____________ **key:** $-\csc x \cot x$
9. $\frac{d}{dx} f(u(x)) = \frac{d}{du}$______$\frac{d}{dx}$______________ $= f'($______________$)\ u'($______________$)$
key: f , u, $u(x)$, x,
10. The extreme value theorem: If f is _______________ then f attains maximum and minimum values in [a,b]. **key:** cts on [a,b],
11. If f has a local extreme values at c, then $f'(c)$ _______________ **key:** =0 or does not exist
12. If f is _______________ and f' exists in _______________ then there exists a $c \in (a,b)$ such that $f'(c) = \frac{f(b)-f(a)}{b-a}$. **key:** cts on [a,b], (a,b) ,
13. If _____ on [a,b], then f is increasing on [a,b].
If _____ on [a,b], then f is decreasing on [a,b].
If _____ on [a,b], then f is concave upward on [a,b].
If _____ on [a,b], then f is concave downward on [a,b]. **key:** $f' > 0$, $f' < 0$, $f'' > 0$, $f'' < 0$,
14. 1st derivative test: Suppose that c is a ___________ number of a continuous f.
(a) If f' changes from _______ at c, then f has a local maximum at c.
(b) If f' changes from _______ at c, then f has a local minimum at c.
(c) If f does not change sign at c, then f has _____ local extreme at c.
key: critical , $+$ to $-$, $-$ to $+$, no
15. 2nd derivative test: Suppose that f'' is continuous near c.
(a) If $f'(c)$ _____ and $f''(c)$ _____ then f has a local minimum at c.

(b) If $f'(c)$ ____ and $f''(c)$ ____ then f has a local maximum at c.
key: $= 0$, > 0, $= 0$, < 0,

16. Guideline for sketching a curve:
   1: ____________
   2: ____________
   3: ____________
   4: intervals of ____________
   5: ____________
   6: ____________
   7: concavity and pts of inflection
   8: sketch the curve **key:** 1: domain, 2: intercepts, 3: symmetry, 4: $\uparrow$ and $\downarrow$, 5: asymptotes, 6: local extreme values,
17. Guideline for finding global extreme values of $f(x)$: (1) solve ________________; (2) list all ________________ and ________________; (3) compare ____ at the points in (2) and look for extreme values.
   key: $f'(x) = 0$, critical numbers, endpoints, f,
18. $\int_a^b f(x)dx = \lim_{n\to\infty} \sum_{i=1}^n f(x_i^*)$ ____ where ______ $[a + (i-1)\Delta x, a + i\Delta x]$ and $\Delta x = \frac{b-a}{n}$. $\sum_{i=1}^n i =$ __________, $\sum_{i=1}^n$ __ $= n(n+1)(2n+1)/6$. **key:** Δx, $x_i^* \in$, $n(n+1)/2.$, i^2,
19. $\int_a^b f(x)dx =$ __ $\int_b^a f(x)dx$ **key:** $-$
20. $\int_a^b cdx =$ __________ **key:** $c(b-a)$
21. __________ $= \int_a^b f(x)dx \pm c\int_a^b g(x)dx$ **key:** $\int_a^b (f(x) \pm cg(x))dx$
22. $\int_a^b f(x)dx + \int_b^c f(x)dx =$ __________ **key:** $\int_a^c f(x)dx$
23. If f ______ on $[a, b]$, then $\int_a^b f(x)dx \geq \int_a^b g(x)dx$. **key:** $\geq g$
24. If __________ on $[a, b]$, then $m(b-a) \leq \int_a^b f(x)dx \leq M(b-a)$. **key:** $m \leq f(x) \leq M$
25. If f is continuous on $[a, b]$, then $(\int_a^x f(t)dt)' =$ __________ for $x \in [a, b]$.
   If F' is continuous in $[a, b]$, then $\int_a^b F'(x)dx =$ __________ **key:** $f(x)$, $F(b) - F(a)$.
26. (1) $\int x^n dx =$ __________ $+C$, where $n \neq -1$ and C is a constant. **key:** $\frac{x^{n+1}}{n+1}$
   (2) $\int kdx =$ __________ **key:** $kx + C$,
   (3) $\int$ __________ $dx = -\cos x + C$ **key:** $\sin x$
   (4) $\int$ __________ $dx = \sin x + C$ **key:** $\cos x$
   (5) $\int$ __________ $dx = \tan x + C$ **key:** $\sec^2 x$
   (6) $\int$ __________ $dx = -\cot x + C$ **key:** $\csc^2 x$
   (7) $\int$ __________ $dx = \sec x + C$ **key:** $\sec x \tan x$
   (8) $\int$ __________ $dx = -\csc x + C$ **key:** $\csc x \cot x$
27. If $u = g(x)$ is differentiable function whose range is I and f is continuous on I, then $\int_a^b f(g(x))g'(x)dx =$ __________ **key:** $\int_{g(a)}^{g(b)} f(u)du$.
28. Suppose that f is continuous on $[-a, a]$.
   If $f(x) = f(-x)$, then $\int_{-a}^a f(x)dx =$ __________.
   If $f(x) = -f(-x)$, then $\int_{-a}^a f(x)dx =$ __________. **key:** $2\int_0^a f(x)dx$, 0
29. The area between $y = f(x)$, $y = g(x)$, $x = a$ and $x = b$ is $A =$ __________
   key: $\int_a^b |f(x) - g(x)|dx$.
30. Let S be a solid that lies between $x = a$ and $x = b$ with crosssectional area $A(x)$, then its volume is $V =$ __________ **key:** $\int_a^b A(x)dx$.
31. The volume of the solid obtained by rotating about the $y-$axis the region under the curve $y = f(x)$ from $x = a$ to $x = b$ is $V =$ __________ due to $dV =$ __________ **key:** $\int_a^b 2\pi x f(x)dx$, $2\pi rhdr$.
32. linear approximation: $f(x)$ ____ $f(a) + f'(a)(x-a)$ **key:** $\approx$
33. differential: $dy =$ __________ **key:** $f'(x)dx$