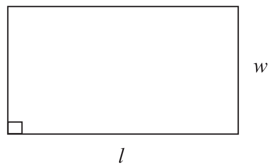
Rectangle

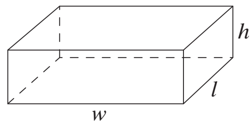
Area $= lw$

Perimeter $= 2l + 2w$



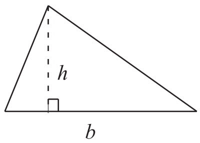
Rectangular Box

Volume $= lwh$



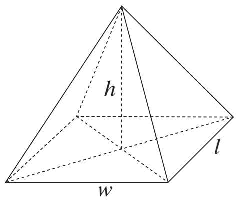
Triangle

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



Pyramid

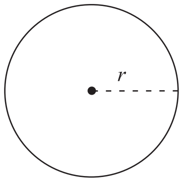
Volume $= \frac{1}{3}lwh$



Circle

Area $= \pi r^2$

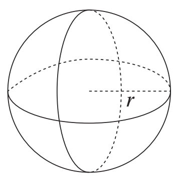
Circumference $= 2\pi r$



Sphere

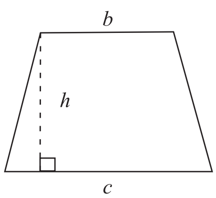
Volume $= \frac{4}{3}\pi r^3$

Surface Area $= 4\pi r^2$



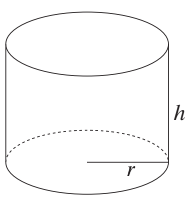
Trapezoid

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



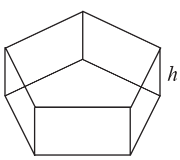
Right Circular Cylinder

Volume $= \pi r^2 h$



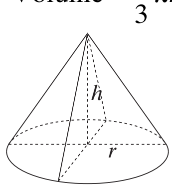
Right Cylinder

Volume = *(Area of Base)(h)*



Cone

Volume $= \frac{1}{3}\pi r^2 h$



Properties of Exponents and Radicals

$a^m \cdot a^n = a^{m+n}$ $\qquad (a^n)^m = a^{nm}$

$\frac{a^n}{a^m} = a^{n-m}$ $\qquad (ab)^n = a^n b^n$

$a^{-n} = \frac{1}{a^n}$ $\qquad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

$(a)^{1/n} = \sqrt[n]{a}$ $\qquad (a)^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ $\qquad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\sqrt[m]{\sqrt[n]{a}} = \sqrt[n]{\sqrt[m]{a}} = \sqrt[mn]{a}$

Special Product Formulas

$X^2 - A^2 = (X+A)(X-A)$

$(X+A)^2 = X^2 + 2AX + A^2$

$(X-A)^2 = X^2 - 2AX + A^2$

$X^3 + A^3 = (X+A)\left(X^2 - AX + A^2\right)$

$(X-A)\left(X^2 + AX + A^2\right) = X^3 - A^3$

The Quadratic Formula

The solutions of the equation $ax^2 + bx + c = 0$ are:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The Pythagorean Theorem

Given a right triangle with legs a and b and hypotenuse c:

$$a^2 + b^2 = c^2$$

Distance Formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Slope of a Line

Given two points (x_1, y_1) and (x_2, y_2) on a line, the slope of the line is the ratio:

$$\frac{y_2 - y_1}{x_2 - x_1}$$

Horizontal lines have slope 0.
Vertical lines have an undefined slope.
Given a line with slope m:

slope of parallel line $= m$.
slope of perpendicular line $= -\frac{1}{m}$.

Limits

Properties of Limits as $x \to a$

Suppose that c is any constant, n is a positive integer, a is a real number, $\lim_{x \to a} f(x) = L_1$, and $\lim_{x \to a} g(x) = L_2$, where L_1 and L_2 are real numbers.

1. $\lim_{x \to a} c = c$
2. $\lim_{x \to a} x = a$
3. $\lim_{x \to a} x^n = a^n$
4. $\lim_{x \to a} \left[f(x) \pm g(x) \right] = \lim_{x \to a} f(x) \pm \lim_{x \to a} g(x) = L_1 \pm L_2$
5. $\lim_{x \to a} \left[f(x) \cdot g(x) \right] = \left[\lim_{x \to a} f(x) \right] \cdot \left[\lim_{x \to a} g(x) \right] = L_1 \cdot L_2$
6. $\lim_{x \to a} \left[\dfrac{f(x)}{g(x)} \right] = \dfrac{\lim_{x \to a} f(x)}{\lim_{x \to a} g(x)} = \dfrac{L_1}{L_2}$ where $L_2 \neq 0$
7. $\lim_{x \to a} \left[c \cdot f(x) \right] = c \cdot \lim_{x \to a} f(x) = c \cdot L_1$
8. $\lim_{x \to a} \sqrt[n]{f(x)} = \sqrt[n]{\lim_{x \to a} f(x)} = \sqrt[n]{L_1} = (L_1)^{1/n}$ where $(L_1)^{1/n}$ is defined.
9. If p is a polynomial function, then $\lim_{x \to a} p(x) = p(a)$.

Summary of Limits for Rational Functions as $x \to \pm\infty$

Consider the function $\dfrac{a_n x^n + a_{n-1} x^{n-1} + \ldots + a_0}{b_m x^m + b_{m-1} x^{m-1} + \ldots + b_0}$, where $a_n \neq 0$ and $b_m \neq 0$.

Case 1: For $m = n$, $\lim_{x \to \pm\infty} f(x) = \dfrac{a_n}{b_m}$.

Case 2: For $m > n$, $\lim_{x \to \pm\infty} f(x) = 0$.

Case 3: For $m < n$, $\lim_{x \to +\infty} f(x) = +\infty$.

(Or $-\infty$ depending on the signs of a_n and b_m.)

Derivatives

In the following table, c and r are real numbers and the functions $f(x)$ and $g(x)$ are differentiable.

1.	$\frac{d}{dx}[c] = 0$	**Derivative of a constant**
2.	$\frac{d}{dx}\left[f(x) \pm g(x)\right] = f'(x) \pm g'(x)$	**Sum and Difference Rule**
3.	$\frac{d}{dx}\left[c \cdot f(x)\right] = c \cdot f'(x)$	**Constant Times a Function Rule**
4.	$\frac{d}{dx}\left[c \cdot x^r\right] = c \cdot r \cdot x^{r-1}$ and $r \neq 0$	**Power Rule**
5.	$\frac{d}{dx}\left[f(x) \cdot g(x)\right] = f(x) \cdot g'(x) + g(x) \cdot f'(x)$	**Product Rule**
6.	$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{\left(g(x)\right)^2}$	**Quotient Rule**
7.	$\frac{d}{dx}\left[f\left(g(x)\right)\right] = f'\left(g(x)\right) \cdot g'(x)$	**Chain Rule**
8.	$\frac{d}{dx}\left[\left(g(x)\right)^r\right] = r\left[g(x)\right]^{r-1} \cdot g'(x)$	**General Power Rule**
9.	$\frac{d}{dx}[\sin x] = \cos x$	
10.	$\frac{d}{dx}[\cos x] = -\sin x$	
11.	$\frac{d}{dx}[\tan x] = \sec^2 x$	
12.	$\frac{d}{dx}[\cot x] = -\csc^2 x$	
13.	$\frac{d}{dx}[\sec x] = \sec x \tan x$	
14.	$\frac{d}{dx}[\csc x] = -\csc x \cot x$	
15.	$\frac{d}{dx}\left[\sin^{-1} x\right] = \frac{1}{\sqrt{1-x^2}}$ for x in $(-1, 1)$	
16.	$\frac{d}{dx}\left[\cos^{-1} x\right] = \frac{-1}{\sqrt{1-x^2}}$ for x in $(-1, 1)$	
17.	$\frac{d}{dx}\left[\tan^{-1} x\right] = \frac{1}{1+x^2}$ for x in $(-\infty, +\infty)$	

Integrals

In the following table, a, b, c, d, and k are real numbers and the functions $f(x)$, $g(x)$, u, and v are integrable.

1. $\int k\,dx = kx + C$ **Integrating a constant**

2. $\int x^r\,dx = \frac{1}{r+1}x^{r+1} + C \qquad (r \neq -1)$ **Power Rule**

3. $\int e^x\,dx = e^x + C$

4. $\int \frac{1}{x}\,dx = \ln|x| + C$

5. $\int kf(x)\,dx = k\int f(x)\,dx$ **Constant Multiple Rule**

6. $\int [f(x) \pm g(x)]\,dx = \int f(x)\,dx \pm \int g(x)\,dx$ **Sum and Difference Rule**

7. $\int u\,dv = uv - \int v\,du$ **Integration by Parts**

8. $\int \frac{1}{ax+b}\,dx = \frac{1}{a}\ln|ax+b| + C$

9. $\int \frac{1}{(ax+b)^2}\,dx = -\frac{1}{a(ax+b)} + C$

10. $\int \frac{1}{x(ax+b)}\,dx = \frac{1}{b}\ln\left|\frac{x}{ax+b}\right| + C$

11. $\int \frac{x}{ax+b}\,dx = \frac{1}{a^2}\left(ax - b\ln|ax+b|\right) + C$

12. $\int \frac{1}{(ax+b)(cx+d)}\,dx = \frac{1}{ad-bc}\ln\left|\frac{ax+b}{cx+d}\right| + C$

13. $\int \frac{x}{(ax+b)(cx+d)}\,dx = \frac{1}{ad-bc}\left(\frac{d}{c}\ln|cx+d| - \frac{b}{a}\ln|ax+b|\right) + C$

14. $\int \sqrt{ax+b}\,dx = \frac{2}{3a}(ax+b)^{\frac{3}{2}} + C$

15. $\int x\sqrt{ax+b}\,dx = \frac{2(3ax-2b)}{15a^2}(ax+b)^{\frac{3}{2}} + C$

16. $\int \frac{1}{x^2-a^2}\,dx = \frac{1}{2a}\ln\left|\frac{x-a}{x+a}\right| + C \qquad \left(x^2 > a^2\right)$

17. $\int \sqrt{x^2 \pm a^2}\,dx = \frac{x}{2}\sqrt{x^2 \pm a^2} \pm \frac{a^2}{2}\ln\left|x+\sqrt{x^2 \pm a^2}\right| + C$

18. $\int \frac{1}{\sqrt{x^2 \pm a^2}}\,dx = \ln\left|x+\sqrt{x^2 \pm a^2}\right| + C$

19. $\int e^{kx}dx = \frac{1}{k}e^{kx} + C$

20. $\int x^n e^{kx}dx = \frac{x^n e^{kx}}{k} - \frac{n}{k}\int x^{n-1}e^{kx}dx$

21. $\int \frac{1}{a+be^{kx}}\,dx = \frac{x}{a} - \frac{1}{ak}\ln\left|a+be^{kx}\right| + C$

22. $\int \ln x\,dx = x\ln x - x + C$

23. $\int x^n \ln x\,dx = \frac{x^{n+1}\ln x}{n+1} - \frac{x^{n+1}}{(n+1)^2} + C$

24. $\int \cos x\,dx = \sin x + C$

25. $\int \sin x\,dx = -\cos x + C$

26. $\int \sec^2 x\,dx = \tan x + C$

27. $\int \tan x\,dx = -\ln\left|\cos x\right| + C$

28. $\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1} x + C$

29. $\int \frac{-1}{\sqrt{1-x^2}}\,dx = \cos^{-1} x + C$

30. $\int \frac{1}{1+x^2}\,dx = \tan^{-1} x + C$