BASIC ALGEBRA FORMULAS

Factoring Formulas

$$x^2-a^2=(x+a)(x-a)$$
$$x^2+2ax+a^2=(x+a)^2$$
$$x^2-2ax+a^2=(x-a)^2$$
$$x^2+(a+b)x+ab=(x+a)(x+b)$$
$$x^3+3ax^2+3a^2x+a^3=(x+a)^3$$
$$x^3-3ax^2+3a^2x-a^3=(x-a)^3$$
$$x^3+a^3=(x+a)(x^2-ax+a^2)$$
$$x^3-a^3=(x-a)(x^2+ax+a^2)$$
$$x^{2n}-a^{2n}=(x^n-a^n)(x^n+a^n)$$

Line/Linear Function

$y=mx+b$ or $f(x)=mx+b$

Graph is a line with point $(0,b)$ and slope m.

Slope

Slope of the line containing the two points (x_1,y_1) and (x_2,y_2) is

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{\text{rise}}{\text{run}}$$

Slope – intercept form

The equation of the line with slope m and y-intercept $(0,b)$ is

$$y=mx+b$$

Point – Slope form

The equation of the line with slope m and passing through the point (x_1,y_1) is

$$y=y_1+m(x-x_1)$$

Distance Formula

If $P_1=(x_1,y_1)$ and $P_2=(x_2,y_2)$ are two points the distance between them is

$$d(P_1,P_2)=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

Exponent Properties

$$a^n a^m=a^{n+m} \qquad \frac{a^n}{a^m}=a^{n-m}=\frac{1}{a^{m-n}}$$
$$(a^n)^m=a^{nm} \qquad a^0=1,\ \ a\neq 0$$
$$(ab)^n=a^n b^n \qquad \left(\frac{a}{b}\right)^n=\frac{a^n}{b^n}$$
$$a^{-n}=\frac{1}{a^n} \qquad \frac{1}{a^{-n}}=a^n$$
$$\left(\frac{a}{b}\right)^{-n}=\left(\frac{b}{a}\right)^n=\frac{b^n}{a^n} \qquad a^{\frac{n}{m}}=\left(a^{\frac{1}{m}}\right)^n=\left(a^n\right)^{\frac{1}{m}}$$

Circle

$$(x-h)^2+(y-k)^2=r^2$$

Graph is a circle with radius r and center (h,k).

Hyperbola

$$\frac{(y-k)^2}{b^2}-\frac{(x-h)^2}{a^2}=1$$

Graph is a hyperbola that opens up and down, has a center at (h,k), vertices b units up/down from the center and asymptotes that pass through center with slope $\pm\frac{b}{a}$.

Quadratic Formula

Solve $ax^2+bx+c=0,\ a\neq 0$

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

Factoring Formulas

$$x^2 - a^2 = (x+a)(x-a)$$

$$x^2 + 2ax + a^2 = (x+a)^2$$

$$x^2 - 2ax + a^2 = (x-a)^2$$

$$x^2 + (a+b)x + ab = (x+a)(x+b)$$

$$x^3 + 3ax^2 + 3a^2x + a^3 = (x+a)^3$$

$$x^3 - 3ax^2 + 3a^2x - a^3 = (x-a)^3$$

$$x^3 + a^3 = (x+a)(x^2 - ax + a^2)$$

$$x^3 - a^3 = (x-a)(x^2 + ax + a^2)$$

$$x^{2n} - a^{2n} = (x^n - a^n)(x^n + a^n)$$

Line/Linear Function

$y = mx + b$ or $f(x) = mx + b$

Graph is a line with point $(0,b)$ and slope *m*.

Slope

Slope of the line containing the two points (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$$

Slope – intercept form

The equation of the line with slope *m* and *y*-intercept $(0,b)$ is

$$y = mx + b$$

Point – Slope form

The equation of the line with slope *m* and passing through the point (x_1, y_1) is

$$y = y_1 + m(x - x_1)$$

Distance Formula

If $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$ are two points the distance between them is

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Exponent Properties

$$a^n a^m = a^{n+m} \qquad \frac{a^n}{a^m} = a^{n-m} = \frac{1}{a^{m-n}}$$

$$(a^n)^m = a^{nm} \qquad a^0 = 1, \quad a \neq 0$$

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

$$a^{-n} = \frac{1}{a^n} \qquad \frac{1}{a^{-n}} = a^n$$

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

Circle

$$(x-h)^2 + (y-k)^2 = r^2$$

Graph is a circle with radius *r* and center (h,k).

Hyperbola

$$\frac{(y-k)^2}{b^2} - \frac{(x-h)^2}{a^2} = 1$$

Graph is a hyperbola that opens up and down, has a center at (h,k), vertices *b* units up/down from the center and asymptotes that pass through center with slope $\pm\frac{b}{a}$.

Quadratic Formula

Solve $ax^2 + bx + c = 0$, $a \neq 0$

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