Mathematics: ALGEBRA

Linear Equations

Slope-intercept form

$y = mx + b \qquad m = \frac{y_2 - y_1}{x_2 - x_1}$

Standard form

$Ax + By = C \qquad m = -\frac{A}{B}$

Polar Coordinates

(x, y) to (r, θ)

$x^2 + y^2 = r^2$

$\tan\theta = \frac{y}{x}$

(r, θ) to (x, y)

$y = r\sin\theta$

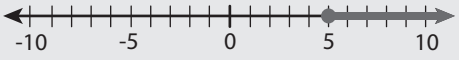
$x = r\cos\theta$

$(x, y) = (r\cos\theta, \sin\theta)$

Inequalities

greater than or equal to

$x \geq 5$

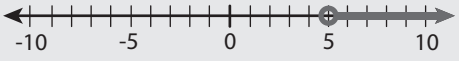


less than or equal to

$x \leq 5$

greater than

$x > 5$



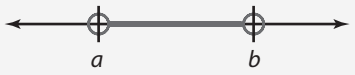
less than

$x < 5$

Compound Inequalities

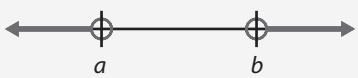
Intersection

$a \leq x \leq b$



Union

$a < x$ or $x > b$



Quadratic Equations

Standard form

$y = ax^2 + bx + c$

axis of symmetry: $x = -\frac{b}{2a}$

vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

Vertex form

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

axis of symmetry: $x = h$

vertex: (h, k)

The Discriminant

If $b^2 - 4ac$ is	there will be	and the parabola
zero	1 real root	has its vertex on the x-axis
positive	2 real roots	has **two** x-intercepts
negative	2 complex roots	has **no** x-intercepts

Transforming Functions

$y = -f(x)$	reflection across the x-axis (vertical reflection)
$y = f(x) + k$	vertical shift up k units ($k > 0$) or down k units ($k < 0$)
$y = kf(x)$	vertical stretch (if $k > 1$) or compression (if $k < 1$)
$y = f(-x)$	reflection across the y-axis (horizontal reflection)
$y = f(x + k)$	horizontal shift right k units ($k < 0$) or left k units ($k > 0$)
$y = f(kx)$	horizontal stretch ($k < 1$) or compression ($k > 1$)

Properties of Logarithms

$\log_b(m) = \frac{\log(m)}{\log(b)}$

$\log_b(mn) = \log_b(m) + \log_b(n)$

$\log_b\left(\frac{m}{n}\right) = \log_b(m) - \log_b(n)$

$\log_b(m^n) = n \times \log_b(m)$

Quadratic Formula

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

Logarithms

$y = \log_b x \rightarrow b^y = x$

$\log x = \log_{10} x$

$\ln x = \log_e x$

Horizontal Asymptotes

For polynomials with first terms $\frac{ax^n}{bx^d}$...

$n < d$	The x-axis ($y = 0$) is a horizontal asymptote.
$n = d$	There is a horizontal asymptote at $y = \frac{a}{b}$.
$n > d$	There is no horizontal asymptote.

Growth and Decay

Growth

$A = P(1 + r)^t$

Decay

$A = P(1 - r)^t$

Compound Interest

$A = P\left(1 + \frac{r}{n}\right)^{nt}$

A = final amount

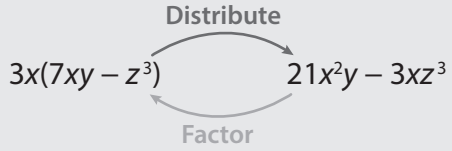
P = initial amount

r = interest rate

t = time period

n = number of times interest is compounded in a time period

Distributing and Factoring



- $a^2 - b^2 = (a + b)(a - b)$
- $a^2 + 2ab + b^2 = (a + b)(a + b) = (a + b)^2$
- $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$
- $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Matrix Determinants

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a\begin{vmatrix} e & f \\ h & i \end{vmatrix} - b\begin{vmatrix} d & f \\ g & i \end{vmatrix} + c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$$

$= a(ei - fh) - b(di - fg) + c(dh - eg)$

Area of a Triangle

$$\boldsymbol{A} = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$