

Standard Form

$$Ax + By = C$$

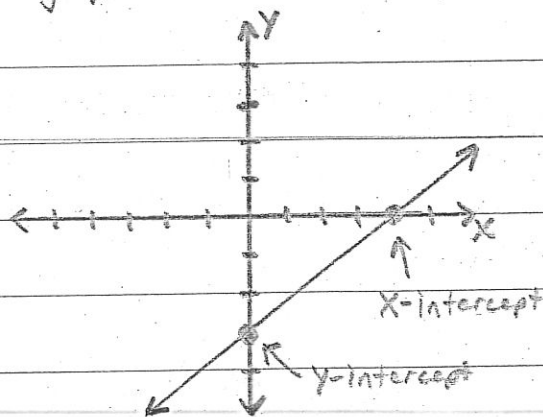
① What are the x- and y-intercepts and graph of $3x - 4y = 12$?

$$3x - 4y = 12$$

↙ ↘

$$3x - 4(0) = 12 \quad 3(0) - 4y = 12$$
$$\frac{3x}{3} = \frac{12}{3} \quad \frac{-4y}{-4} = \frac{12}{-4}$$
$$x = 4 \quad y = -3$$

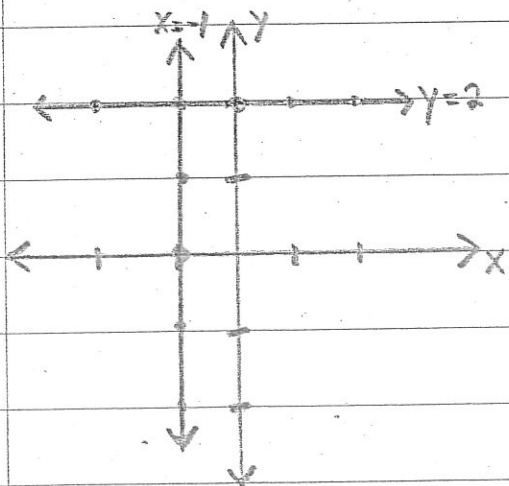
(x-intercept) (y-intercept)



② What is the graph?

A $x = -1$ B $y = 2$

$$x + 0y = -1 \quad 0x + y = 2$$



③ Write in standard form

A $y = -\frac{3}{7}x + 5$
 $(y = -\frac{3}{7}x + 5)(7)$
 $7y = -3x + 35$
 $+3x \quad +3x$

$$3x + 7y = 35$$

B $y - 2 = -\frac{1}{3}(x + 6)$
 $(y - 2 = -\frac{1}{3}x - 2)(3)$
 $3y - 6 = -x - 6$
 $+x \quad +x$

$$x + 3y - 6 = -6$$

$+6 \quad +6$

$$x + 3y = 0$$

Parallel and Perpendicular Lines

Parallel Lines \Rightarrow Slopes are Equal

Ex. $y = -3x + 8$

$y = -3x - 7$

Slope is equal, lines are parallel.

Perpendicular Lines \Rightarrow Slopes are Opposite Reciprocals

Ex. $y = \frac{2}{3}x + 9$

$y = -\frac{3}{2}x - 2$

Since $\frac{2}{3} \cdot (-\frac{3}{2}) = -1$, lines are perpendicular

① A line passes through $(-3, -1)$ and is parallel to $y = 2x + 3$.
What equation represents the line in slope-intercept form?

$$y = mx + b$$

$$y = 2x + b$$

$$-1 = 2(-3) + b$$

$$-1 = -6 + b$$

$$\frac{+6 \quad +6}{5 = b}$$

$$5 = b$$

$$y = 2x + 5$$

② A line passes through $(5, -2)$ and is perpendicular to $y = 5x + 4$.
Write an equation (Slope-Intercept).

$$y = mx + b$$

$$y = -\frac{1}{5}x + b$$

$$-2 = -\frac{1}{5}(5) + b$$

$$-2 = -1 + b$$

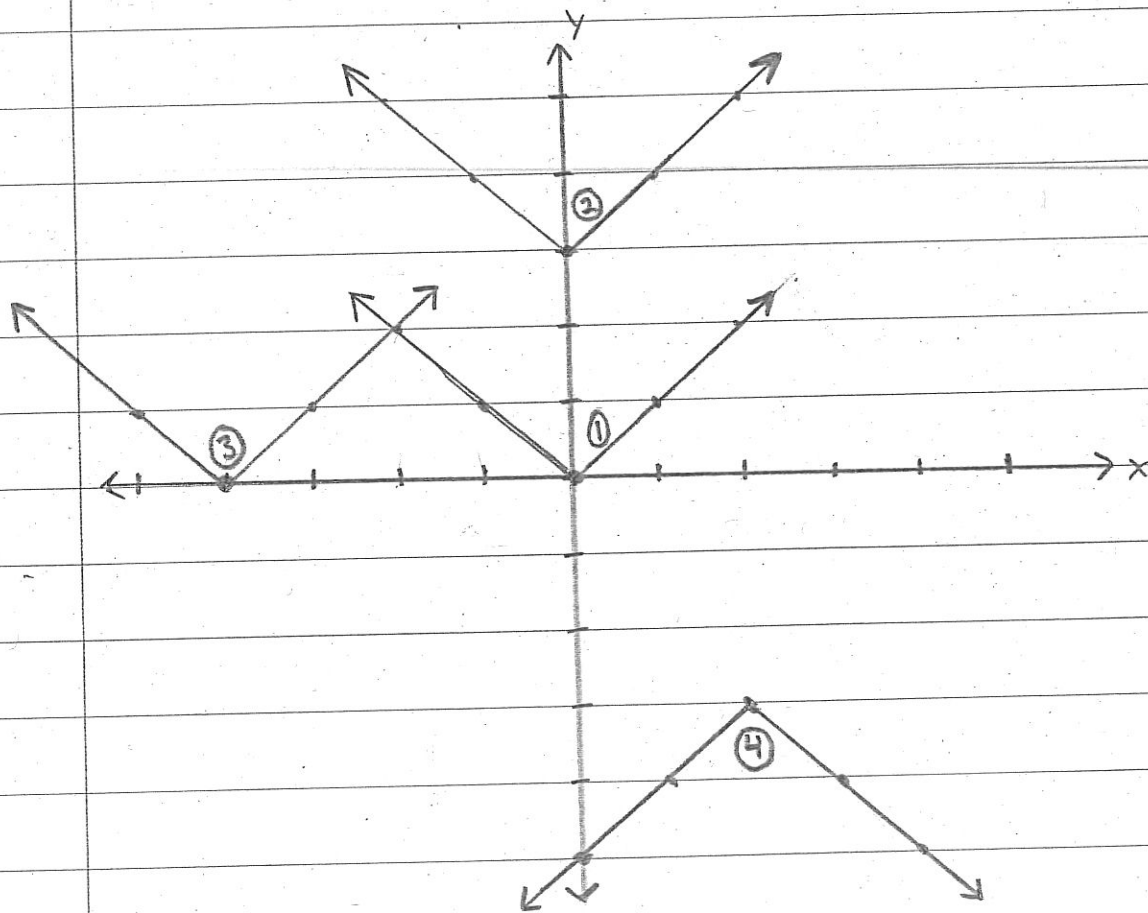
$$\frac{+1 \quad +1}{-1 = b}$$

$$-1 = b$$

$$y = -\frac{1}{5}x - 1$$

Graphing Absolute Value Functions

Graph $y = |x|$, $y = |x| + 3$, $y = |x + 4|$, and $y = -|x - 2| - 3$.



①		②		③		④	
x	y	x	y	x	y	x	y
1	1	0	3	-4	0	2	-3
0	0	-1	4	-3	1	1	-4
-1	1	1	4	-5	1	3	-4
2	2	2	5	-6	2	0	-5
-2	2	-2	5	-2	2	4	-5

Solving Systems of Equations by Substitution

What is the solution of the system?

$$\begin{aligned} \textcircled{1} \begin{cases} 2x + y = -7 \\ y = 4x + 5 \end{cases} & \quad \begin{aligned} 2x + (4x + 5) &= -7 \\ 2x + 4x + 5 &= -7 \\ -6x + 5 &= -7 \\ \quad \quad \quad -5 & \quad -5 \\ \hline \quad \quad \quad 6x &= -12 \\ \quad \quad \quad \frac{6}{6} & \quad \frac{6}{6} \\ \quad \quad \quad \boxed{x = -2} & \end{aligned} \\ y = 4x + 5 & \\ y = 4(-2) + 5 & \\ y = -8 + 5 & \\ \boxed{y = -3} & \quad \boxed{(-2, -3)} \end{aligned}$$

$$\begin{aligned} \textcircled{2} \begin{cases} y = 14x \\ y = \frac{1}{2}(28x + 15) \end{cases} & \quad \textcircled{3} \begin{cases} 4x + 2y = 20 \\ y = -2x + 10 \end{cases} \\ 14x = \frac{1}{2}(28x + 15) & \quad 4x + 2(-2x + 10) = 20 \\ 14x = \frac{1}{2}(28x) + \frac{1}{2}(15) & \quad 4x - 4x + 20 = 20 \\ 14x = 14x + \frac{15}{2} & \quad 20 = 20 \\ \begin{array}{r} -14x \quad -14x \\ \hline 0 \neq \frac{15}{2} \end{array} & \quad \text{Infinitely Many Solutions} \\ \boxed{\text{No Solution}} & \end{aligned}$$

Solving Systems of Equations by Elimination

Solve each system using elimination.

$$\textcircled{1} \begin{cases} 3x - 2y = 0 \\ 4x + 2y = 14 \end{cases} \text{ Add the equations}$$

$$\begin{array}{r} 3x - 2y = 0 \\ 4x + 2y = 14 \\ \hline 7x = 14 \\ \hline x = 2 \end{array}$$

$$x = 2$$

$$4x + 2y = 14$$

$$4(2) + 2y = 14$$

$$8 + 2y = 14$$

$$\begin{array}{r} 8 + 2y = 14 \\ -8 \quad -8 \\ \hline 2y = 6 \end{array}$$

$$2y = 6$$

$$\begin{array}{r} 2y = 6 \\ -2 \quad -2 \\ \hline y = 3 \end{array}$$

$$y = 3$$

$$(2, 3)$$

$$\textcircled{2} \begin{cases} (6x - 3y = 15) (4) \\ (7x + 4y = 10) (3) \end{cases}$$

$$24x - 12y = 60$$

$$\begin{array}{r} 24x - 12y = 60 \\ 21x + 12y = 30 \\ \hline 45x = 90 \\ \hline x = 2 \end{array}$$

$$45x = 90$$

$$x = 2$$

$$x = 2$$

$$6x - 3y = 15$$

$$6(2) - 3y = 15$$

$$12 - 3y = 15$$

$$\begin{array}{r} 12 - 3y = 15 \\ -12 \quad -12 \\ \hline -3y = 3 \end{array}$$

$$-3y = 3$$

$$\begin{array}{r} -3y = 3 \\ -3 \quad -3 \\ \hline y = -1 \end{array}$$

$$y = -1$$

$$(2, -1)$$

Linear Inequalities

Is the ordered pair a solution of $y < x - 2$?

a) $(1, 5)$

$$y < x - 2$$

$$5 < 1 - 2$$

$$5 < -1 \quad \times$$

Not a Solution

b) $(6, -2)$

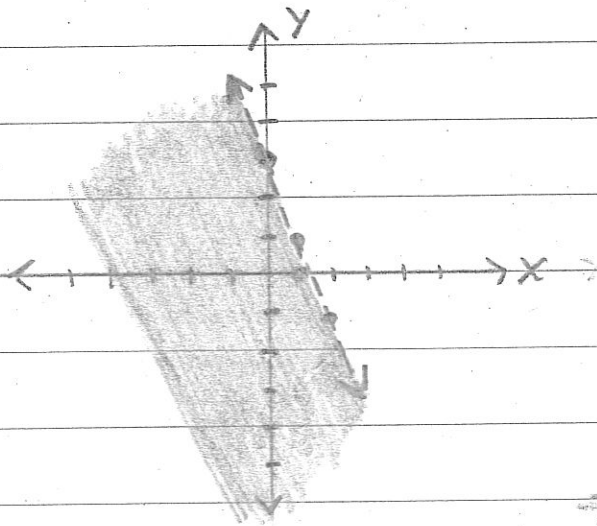
$$y < x - 2$$

$$-2 < 6 - 2$$

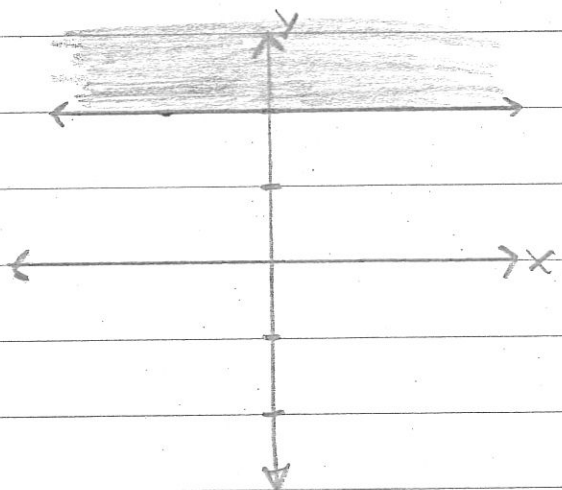
$$-2 < 4 \quad \checkmark$$

$(6, -2)$ is a solution

What is the graph of $y < -2x + 3$?



What is the graph of $y \geq 2$?



Systems of Linear Inequalities

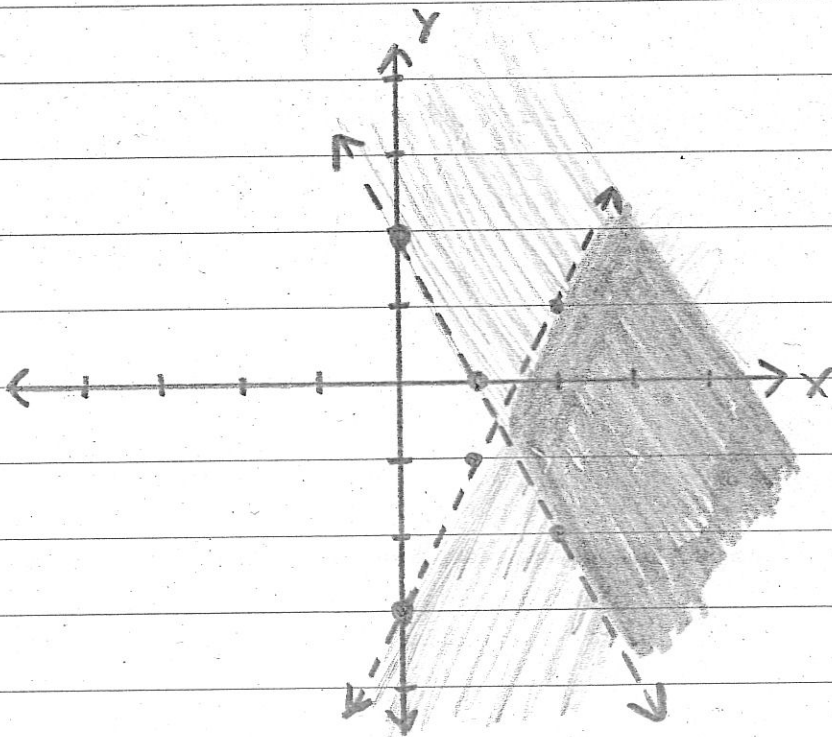
What is the graph of the system?

$$y < 2x - 3$$

$$2x + y > 2$$

$$\begin{array}{r} -2x \quad -2x \\ \hline \end{array}$$

$$y > -2x + 2$$



Zero and Negative Exponents

Zero as an exponent.

$$a) 4^0 = 1 \quad b) (-3)^0 = 1 \quad c) (5,14)^0 = 1 \quad d) X^0 = 1$$

Negative exponents

$$a) 7^{-3} = \frac{1}{7^3} \quad b) (-5)^{-2} = \frac{1}{(-5)^2} \quad c) X^4 Y^{-3} = \frac{X^4}{Y^3}$$

Simplify.

$$\textcircled{1} 4^{-3} = \frac{1}{4^3} = \boxed{\frac{1}{64}}$$

$$\textcircled{2} \frac{6X^{-3}Z^{-5}}{Y^{-4}} = \boxed{\frac{6Y^4}{X^3Z^5}}$$

\textcircled{3} What is the value of $5x^2y^{-3}$ for $x=6$ and $y=3$?

$$5x^2y^{-3} = \frac{5x^2}{y^3}$$

$$= \frac{5(6^2)}{3^3}$$

$$= \frac{5(36)}{27}$$

$$= \frac{20}{3} = \boxed{6\frac{2}{3}}$$

Multiplying Powers with the Same Base

$$a^m \cdot a^n = a^{m+n}$$

What is each expression written using each base once?

$$\textcircled{1} 12^3 \cdot 12^5 = (12 \cdot 12 \cdot 12) \cdot (12 \cdot 12 \cdot 12 \cdot 12 \cdot 12) = 12^{3+5} = \boxed{12^8}$$

$$\textcircled{2} (7)^{-3} (7)^9 = \frac{7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7}{7 \cdot 7 \cdot 7} = 7^{9-3} = \boxed{7^6}$$

What is the simplified form of each expression?

$$\begin{aligned} \textcircled{3} 4y^5 \cdot 9y^{-12} &= (4 \cdot 9)(y^{5-12}) \\ &= 36y^{-7} \\ &= \boxed{\frac{36}{y^7}} \end{aligned}$$

$$\begin{aligned} \textcircled{4} 2a \cdot 9b^4 \cdot 3a^2 &= (2 \cdot 9 \cdot 3)(a \cdot a^2)(b^4) \\ &= \boxed{54a^3b^4} \end{aligned}$$

Multiplying with Scientific Notation

$$\begin{aligned} \textcircled{5} (1.13 \times 10^{-7})(9.98 \times 10^5)(3.34 \times 10^{20}) \\ (1.13 \times 9.98 \times 3.34)(10^{-7} \cdot 10^5 \cdot 10^{20}) \\ \approx 37.7 \times 10^{20} = \boxed{3.77 \times 10^{21}} \end{aligned}$$

More Multiplication Properties of Exponents

a) $(a^m)^n = a^{mn}$ b) $(ab)^n = a^n b^n$

Simplify.

① $(x^3)^7 = x^{21}$ ② $(m^{\frac{2}{3}})^{\frac{1}{3}} = m^{\frac{2}{9}}$

③ $x^2(x^6)^{-4} = x^2(x^{-24}) = x^{-22} = \frac{1}{x^{22}}$

④ $(2b)^{-4} = 2^{-4} b^{-4} = \frac{1}{16b^4}$

⑤ $(n^{\frac{1}{2}})^{10} (4mn^{-\frac{2}{3}})^3 = (n^5)(4^3 m^3 n^{-2})$
 $= 64m^3 n^3$

Scientific Notation Example

⑥ $\frac{1}{2}mv^2$ Kinetic energy

$m = 1.3 \times 10^3 \text{ kg}$

$v = 3.1 \times 10^3 \text{ m/s}$

$\frac{1}{2}(1.3 \times 10^3)(3.1 \times 10^3)^2$

$\frac{1}{2}(1.3)(10^3)(3.1^2)(10^6)$

$(\frac{1}{2} \times 1.3 \times 3.1 \times 3.1)(10^3 \cdot 10^6)$

$6.2465 \times 10^9 \text{ joules}$