# Writing Linear Equations

Start by stressing the importance of understanding the differences forms of a linear equation because it will help in writing equations.

Arrange the given linear equations, 1-9, so they are in the column corresponding to their form.

	Slope-Intercept Form $y = mx + b$	Point-Slope Form $y - y_1 = m(x - x_1)$	Standard Form $ax + by = c$
1. $y - 5 = \dfrac{2}{3}(x + 2)$ 2. $y = -\dfrac{1}{2}x + 6$ 3. $2x - 3y = 12$ 4. $y = 5x + 14$ 5. $y + 3 = 5(x - 7)$ 6. $5x - 7y = 10$ 7. $y - 11 = -\dfrac{5}{8}(x - 9)$ 8. $12x + y = 2$ 9. $y = \dfrac{4}{7}x - 3$	2. $y = -\dfrac{1}{2}x + 6$ 4. $y = 5x + 14$ 9. $y = \dfrac{4}{7}x - 3$	1. $y - 5 = \dfrac{2}{3}(x + 2)$ 5. $y + 3 = 5(x - 7)$ 7. $y - 11 = -\dfrac{5}{8}(x - 9)$	3. $2x - 3y = 12$ 6. $5x - 7y = 10$ 8. $12x + y = 2$
What information does each form give us?	1. Slope $= m$ 2. y-intercept $= b =$ $(0, b)$	1. Slope $= m$ 2. A point $= (x_1, y_1)$	1. x-intercept $= \left(\dfrac{c}{a}, 0\right)$ 2. y-intercept $= \left(0, \dfrac{c}{b}\right)$

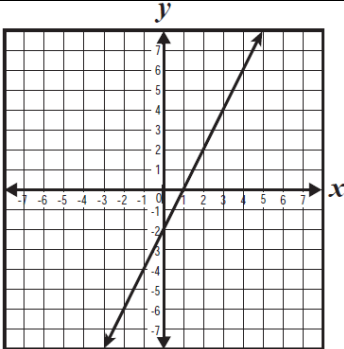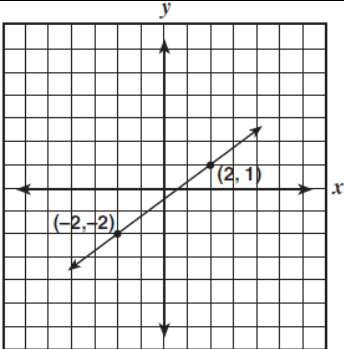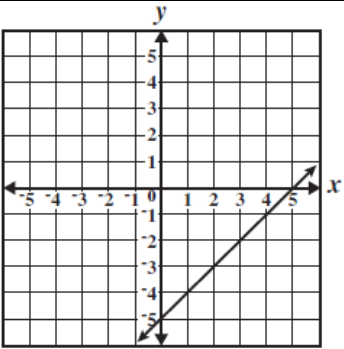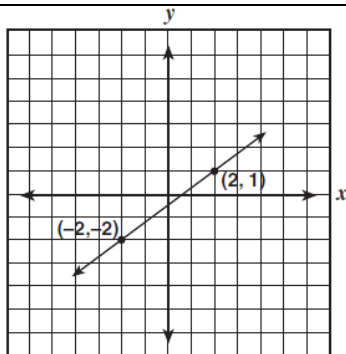| **Given a graph**, write an equation for each form of a line.

* After you find the intercepts you could then find the slope to use the slope-intercept form. Then transform it into standard form. Either way have students notice that the intercepts are not the coefficients. |
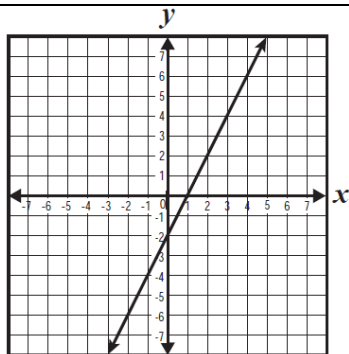
1. Slope = m
$$\frac{Rise}{Run} = \frac{up\ 2}{right\ 1} = \frac{2}{1} = 2$$
2. y-intercept $= (0,-2)$
$\quad b = -2$
$\therefore y = 2x - 2$ |

1. Slope $= m$
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{1-(-2)}{2-(-2)} = \frac{1+2}{2+2} = \frac{3}{4}$$
2. A point $= (x_1, y_1) = (2,1)$
$\therefore y - 1 = \frac{3}{4}(x-2)$ |
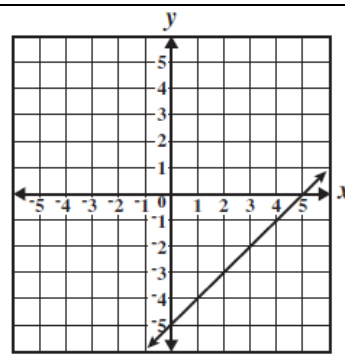
1. x-intercept $= (5,0)$
2. y-intercept $= (0,-5)$
If $\frac{c}{a} = 5$, then $a = \frac{c}{5}$ and
If $\frac{c}{b} = -5$, then $b = \frac{c}{-5}$

Substitute $a = \frac{c}{5}$ and $b = \frac{c}{-5}$
$\frac{c}{5}x + \frac{c}{-5}y = c$, clear denom.
$cx - cy = 5c$, now let $c = 1$ to get
$x - y = 5$ *
$\therefore x - y = 5$ |
| **You Try:** Write an equation of the line graphed below in all 3 forms.
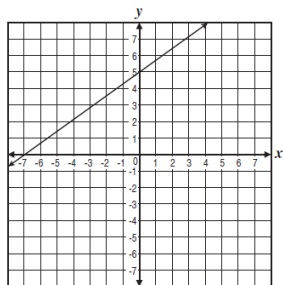
 | Slope-Intercept Form
$$y = mx + b$$
1. Slope = m
$$\frac{Rise}{Run} = \frac{up\ 5}{right\ 7} = \frac{5}{7}$$
2. y-intercept $= (0,5)$
$\quad b = 5$

$\therefore y = \frac{5}{7}x + 5$ | Point-Slope Form
$$y - y_1 = m(x - x_1)$$
1. Slope $= m$
$$\frac{Rise}{Run} = \frac{up\ 5}{right\ 7} = \frac{5}{7}$$
2. A point $= (x_1, y_1) = (0,5)$

$\therefore y - 5 = \frac{5}{7}(x-0)$
$y - 5 = \frac{5}{7}x$ | Standard Form
$$ax + by = c$$
1. x-intercept $= (-7,0)$
2. y-intercept $= (0,5)$
3. Transform into Standard form.
*Notice the coefficients.
$$-\frac{5}{7}x + y = \frac{5}{7}x - \frac{5}{7}x + 5$$
$$-\frac{5}{7}x + y = 5$$
$$-7\left(-\frac{5}{7}x\right) - 7(y) = -7(5)$$
$$5x - 7y = -35$$ |

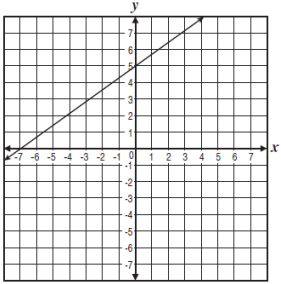| **Given a slope and y-intercept** write an equation for each form of a line. Slope = $\dfrac{2}{3}$ y-intercept = $(0,-5)$	1. Substitute $m = \dfrac{2}{3}$ 2. Substitute $b = -5$ $\therefore y = \dfrac{2}{3}x - 5$	1. Substitute $m = \dfrac{2}{3}$ 2. Substitute the y-intercept for a point. $(x_1, y_1) =$ $(0, -5)$ $\therefore y + 5 = \dfrac{2}{3}(x - 0)$ $y + 5 = \dfrac{2}{3}x$	1. Substitute $m = \dfrac{2}{3}$ 2. Substitute $b = -5$ 3. Transform the equation into standard form. $-\dfrac{2}{3}x + y = \dfrac{2}{3}x - \dfrac{2}{3}x - 5$ $-\dfrac{2}{3}x + y = -5$ $-3\left(-\dfrac{2}{3}x\right) - 3(y) = -3(-5)$ $2x - 3y = 15$
You Try: Write an equation of the line when given a slope and y-intercept in all 3 forms. Slope = 5 y-intercept = -2	1. Substitute $m = 5$ 2. Substitute $b = -2$ $\therefore y = 5x - 2$	1. Substitute $m = 5$ 2. Substitute the y-intercept for a point. $(x_1, y_1) =$ $(0, -2)$ $\therefore y + 2 = 5(x - 0)$ $y + 2 = 5x$	1. Substitute $m = 5$ 2. Substitute $b = -2$ 3. Transform the equation into the standard form. $-5x + y = 5x - 5x - 2$ $-5x + y = -2$ $-1(-5x) - 1(y) = -1(-2)$ $5x - y = 2$
Given a slope and a point write an equation for each form of a line. Slope = $-\dfrac{2}{5}$ Point = $(-5, 3)$	1. Substitute $m = -\dfrac{2}{5}$ 2. Substitute $x = -5$ and $y = 3$ to solve for b. $3 = -\dfrac{2}{5}(-5) + b$ $3 = 2 + b$ $3 - 2 = 2 - 2 + b$ $1 = b$ 3. Sub. $m = -\dfrac{2}{5}$ and $b = 1$ $\therefore y = -\dfrac{2}{5}x + 1$	1. Substitute $m = -\dfrac{2}{5}$ 2. Substitute the point. $(x_1, y_1) = (-5,\ 3)$ $\therefore y - 3 = -\dfrac{2}{5}(x + 5)$	1. Transform point-slope form. $5(y) + 5(-3) = 5\left(-\dfrac{2}{5}\right)(x + 5)$ $5y - 15 = -2(x + 5)$ $5y - 15 = -2x - 10$ $2x + 5y - 15 = -2x + 2x - 10$ $2x + 5y - 15 + 15 = -10 + 15$ $2x + 5y = 5$

You Try: Write an equation of the line when given a slope and a point in all 3 forms. Slope = $-\dfrac{1}{4}$ Point = $(-8,1)$	1. Substitute $m=-\dfrac{1}{4}$ 2. Substitute $x=-8$ and $y=1$ to solve for b. $1=-\dfrac{1}{4}(-8)+b$ $1=2+b$ $1-2=2-2+b$ $-1=b$ 3. Sub. $m=-\dfrac{1}{4}$ and $b=-1$ $\therefore y=-\dfrac{1}{4}x-1$	1. Substitute $m=-\dfrac{1}{4}$ 2. Substitute the point. $(x_1,y_1)=(-8,1)$ $\therefore y-1=-\dfrac{1}{4}(x+8)$	1. Transform point-slope form. $4(y)+4(-1)=4\left(-\dfrac{1}{4}\right)(x+8)$ $4y-4=-1(x+8)$ $4y-4=-x-8$ $x+4y-4=-x+x-8$ $x+4y-4+4=-8+4$ $x+4y=-4$
Given two points write an equation for each form of a line. Point = $(8,-8)$ Point = $(-4,-2)$	1. Sub. $=m=\dfrac{y_2-y_1}{x_2-x_1}$ $\dfrac{-8+2}{8+4}=\dfrac{-6}{12}=-\dfrac{1}{2}$ 2. Substitute $x=-4$ and $y=-2$ to solve for b. $-2=-\dfrac{1}{2}(-4)+b$ $-2=2+b$ $-2-2=2-2+b$ $-4=b$ 3. Sub. $m=-\dfrac{1}{4}$ and $b=-4$ $\therefore y=-\dfrac{1}{2}x-4$	1. Slope $=m=\dfrac{y_2-y_1}{x_2-x_1}$ $\dfrac{-8-(-2)}{8-(-4)}=\dfrac{-8+2}{8+4}=\dfrac{-6}{12}=-\dfrac{1}{2}$ 2. A point $=(x_1,y_1)=(-4,-2)$ $\therefore y+2=-\dfrac{1}{2}(x+2)$	1. Transform slope-inter. form. $\dfrac{1}{2}x+y=-\dfrac{1}{2}x+\dfrac{1}{2}x-4$ $\dfrac{1}{2}x+y=-4$ $2\left(\dfrac{1}{2}x\right)+2(y)=2(-4)$ $x+2y=-8$
You Try: Write an equation of the line when given two points in all 3 forms. Point = $(9,-2)$ Point = $(-3,2)$	1. Sub. $=m=\dfrac{y_2-y_1}{x_2-x_1}$ $\dfrac{-2-2}{9+3}=\dfrac{-4}{12}=-\dfrac{1}{3}$ 2. Substitute $x=-3$ and $y=2$ to solve for b. $2=-\dfrac{1}{3}(-3)+b$ $2=1+b$ $2-1=1-1+b$ $1=b$ 3. Sub. $m=-\dfrac{1}{3}$ and $b=1$ $\therefore y=-\dfrac{1}{3}x+1$	1. Slope $=m=\dfrac{y_2-y_1}{x_2-x_1}$ $\dfrac{-2-2}{-9-(-3)}=\dfrac{-2-2}{9+3}=\dfrac{-4}{12}=-\dfrac{1}{3}$ 2. A point $=(x_1,y_1)=(-3,2)$ $\therefore y-2=-\dfrac{1}{3}(x+3)$	1. Transform slope-inter. form. $\dfrac{1}{3}x+y=-\dfrac{1}{3}x+\dfrac{1}{3}x+1$ $\dfrac{1}{3}x+y=1$ $3\left(\dfrac{1}{3}x\right)+3(y)=3(1)$ $x+3y=3$

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Arrange the given linear equations, 1-9, so they are in the column corresponding to their form.

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4. $y = 5x + 14$			
5. $y + 3 = 5(x - 7)$			
6. $5x - 7y = 10$			
7. $y - 11 = -\dfrac{5}{8}(x - 9)$			
8. $12x + y = 2$			
9. $y = \dfrac{4}{7}x - 3$			
What information does each form give us?			
Given a graph, write an equation for each form of a line.			

You Try: Write an equation of the line graphed below in all 3 forms.	Slope-Intercept Form $y = mx + b$	Point-Slope Form $y - y_1 = m(x - x_1)$	Standard Form $ax + by = c$
Given a slope and _y-intercept_ write an equation for each form of a line. Slope = $\dfrac{2}{3}$ _y_-intercept = $(0,-5)$			
You Try: Write an equation of the line when given a slope and _y_-intercept in all 3 forms. Slope = 5 _y_-intercept = -2			

Given a slope and a point write an equation for each form of a line. Slope = $-\dfrac{2}{5}$ Point = $(-5, 3)$			
You Try: Write an equation of the line when given a slope and a point in all 3 forms. Slope = $-\dfrac{1}{4}$ Point = $(-8, 1)$			

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Given two points write an equation for each form of a line. Point $= (8, -8)$ Point $= (-4, -2)$			
You Try: Write an equation of the line when given two points in all 3 forms. Point $= (9, -2)$ Point $= (-3, 2)$			