Student Name: ______________________	Contact Person Name: ______________________
Date: ______________________	Phone Number: ______________________

TAKS

Texas Assessment of Knowledge and Skills

Exit Level Math Review

Lesson 10

Linear Equations

TAKS Objective 3 – Demonstrate an understanding of linear functions

Lesson Objectives:

- Putting equations into $y = mx + b$ form
- Find the equation of a parallel and perpendicular line

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The Texas Assessment of Knowledge and Skills (TAKS) exit level exam covers ten learning objectives. These lessons are designed to teach math concepts specific to each objective as well as strategies to consider when approaching typical TAKS questions. To successfully complete the TAKS exit level exam, the student should be able to:

1) **Describe functional relationships in a variety of ways.**
2) **Demonstrate an understanding of the properties and attributes of functions.**
3) **Demonstrate an understanding of linear functions.**
4) **Formulate and use linear equations and inequalities.**
5) **Demonstrate an understanding of quadratic equations and other nonlinear functions.**
6) **Demonstrate an understanding of geometric relationships and spatial reasoning.**
7) **Demonstrate an understanding of two- and three-dimensional representations of geometric relationships and shapes.**
8) **Demonstrate an understanding of concepts and uses of measurement and similarity.**
9) **Demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems.**
10) **Demonstrate an understanding of the mathematical processes and tools used in problem solving.**

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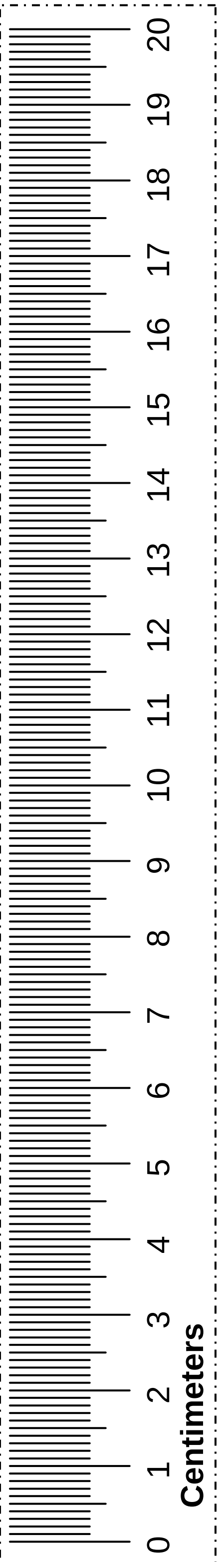
TAKS Mathematics Chart



Length

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

Capacity and Volume

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

Mass and Weight

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

Time

1 year = 365 days

1 year = 12 months

1 year = 52 weeks

1 week = 7 days

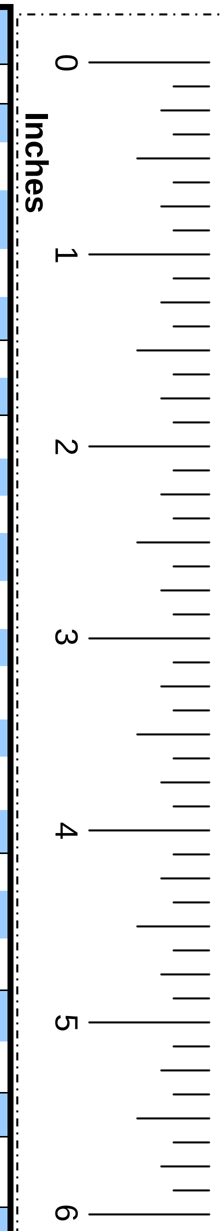
1 day = 24 hours

1 hour = 60 minutes

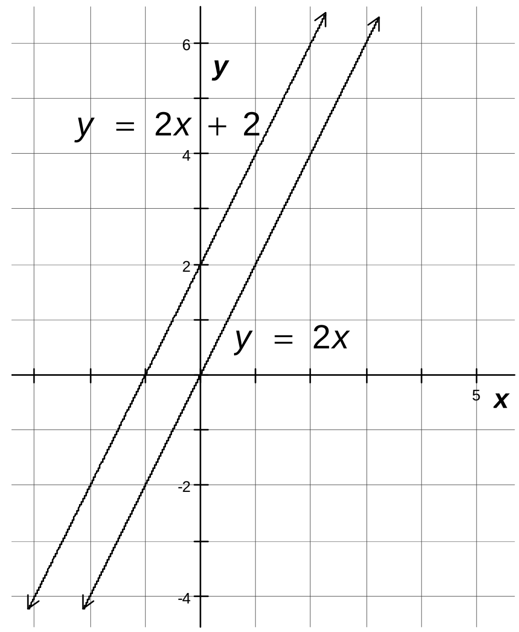
1 minute = 60 seconds

TAKS Mathematics Chart

Perimeter	Rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	Circle	$C = 2\pi r$ or $C = \pi d$
Area	Rectangle	$A = lw$ or $A = bh$
	Triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1 + b_2)h}{2}$
	Regular polygon	$A = \frac{1}{2}aP$
	Circle	$A = \pi r^2$
P represents the perimeter of the base of a three-dimensional figure.		
B represents the area of the base of a three-dimensional figure.		
Surface Area	Cube (total)	$S = 6s^2$
	Prism (lateral)	$S = Ph$
	Prism (total)	$S = Ph + 2B$
	Pyramid (lateral)	$S = \frac{1}{2}Pl$
	Pyramid (total)	$S = \frac{1}{2}Pl + B$
	Cylinder (lateral)	$S = 2\pi rh$
	Cylinder (total)	$S = 2\pi rh + 2\pi r^2$ or $S = 2\pi r(h + r)$
	Cone (lateral)	$S = \pi rl$
	Cone (total)	$S = \pi rl + \pi r^2$ or $S = \pi r(l + r)$
	Sphere	$S = 4\pi r^2$
Volume	Prism or Cylinder	$V = Bh$
	Pyramid or Cone	$V = \frac{1}{3}Bh$
	Sphere	$V = \frac{4}{3}\pi r^3$
Special Right	30°, 60°, 90°	$x, x\sqrt{3}, 2x$
Triangles	45°, 45°, 90°	$x, x, x\sqrt{2}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Distance Formula		$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line		$m = \frac{y_2 - y_1}{x_2 - x_1}$
Midpoint Formula		$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
Quadratic Formula		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of an Equation		$y = mx + b$
Point-Slope Form of an Equation		$y - y_1 = m(x - x_1)$
Standard Form of an Equation		$Ax + By = C$
Simple Interest Formula		$I = prt$

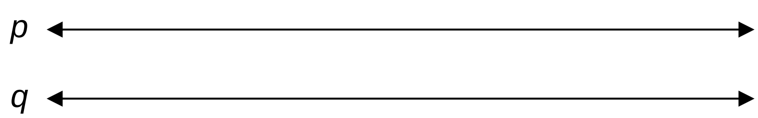


In the previous lesson, we observed how changing the slope, *m*, and the *y*-intercept, *b*, of a linear equation affected its graph. Recall that changing the *y*-intercept, *b*, of the equation shifted the graph up or down.



The axes to the right show the graphs of the equations $y = 2x$ and $y = 2x + 2$. These two lines have the same slope, but different *y*-intercepts. Because of this, they are parallel.

Two lines are **parallel** if they never intersect. On a set of axes, parallel lines have the same slope



Lines p and q are parallel, and we write this $\overleftrightarrow{p} \parallel \overleftrightarrow{q}$.

Example

Which equation represents a line that is parallel to $y = \frac{1}{3}x - 1$, and goes through the point $(3, 5)$.

A $y = \frac{1}{3}x + 4$

B $y = -\frac{1}{3}x + 2$

C $y = \frac{1}{3}x + 2$

D $y = 3x - 4$

Solution

First, we can eliminate the choices that are not parallel. These are the lines that do not have the same slope. The line $y = \frac{1}{3}x - 1$ has a slope of $\frac{1}{3}$.

Neither choice **B**, $y = \left(-\frac{1}{3}\right)x + 2$, nor **D**, $y = (3)x - 4$, has a slope of $\frac{1}{3}$.

~~**B** $y = -\frac{1}{3}x + 2$~~

~~**D** $y = 3x - 4$~~

Cross these choices out.

Using the other two choices, we need to determine which one goes through the point $(3, 5)$. Substitute these values in for *x* and *y* into each equation and see which one works.

Check choice **A** $y = \frac{1}{3}x + 4$.

$(3, 5)$

$$5 = \frac{1}{3}(3) + 4$$

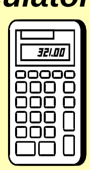
$$5 = 1 + 4 \checkmark$$

Problem Solving Tip

When multiplying a fraction by a whole number, the whole number multiplies the numerator only. Also, if multiplying by a number the same as the denominator, they cancel each other out.

Since the point $(3, 5)$ is a solution to the equation, the line passes through this point. This means choice **A**, $y = \frac{1}{3}x + 4$, is the answer.

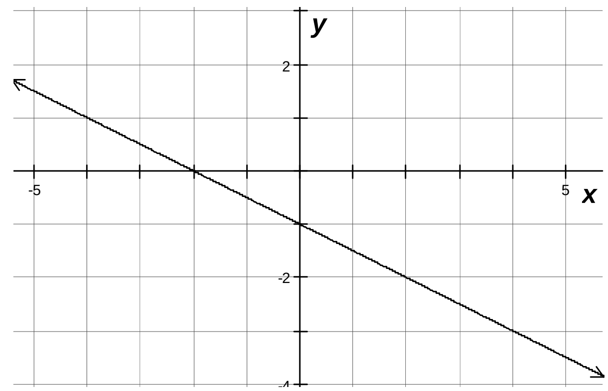
Calculator Tip



Check your answer using the graphing calculator. Graph the equation, you think is the answer by entering it in as y_1. While looking at the graph, press 2nd GRAPH *Then press* ENTER *on the value button. Enter the x-value of the point, and see if it corresponds to the y-value.*

Example

Which equation represents a line that is parallel to the given linear graph and goes through the point $(-1, 2)$.



A $y = -2x + 4$

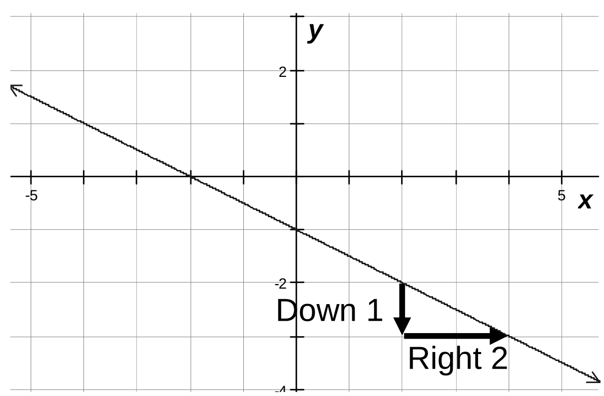
B $y = -\frac{1}{2}x + 2$

C $y = -\frac{1}{2}x + \frac{3}{2}$

D $y = 2x + 4$

Solution

First, we must determine the slope of the given function. Slope is determined by rise over run.



$\text{slope} = \frac{-1}{2} = -\frac{1}{2}$

The slope of the line is $-\frac{1}{2}$. Neither choice **A**, $y = -2x + 4$, nor **D**, $y = 2x + 4$, has a slope of $-\frac{1}{2}$.

~~**A** $y = -2x + 4$~~

~~**D** $y = 2x + 4$~~

Cross these choices out.

Check to see which of the remaining linear equations goes through the point $(-1, 2)$ by substituting the corresponding values in for *x* and *y*.

Check choice **B** $y = -\frac{1}{2}x + 2$.

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

By process of elimination, choice **C** should be the answer. We will double check to see if this is true.

Problem Solving Tip

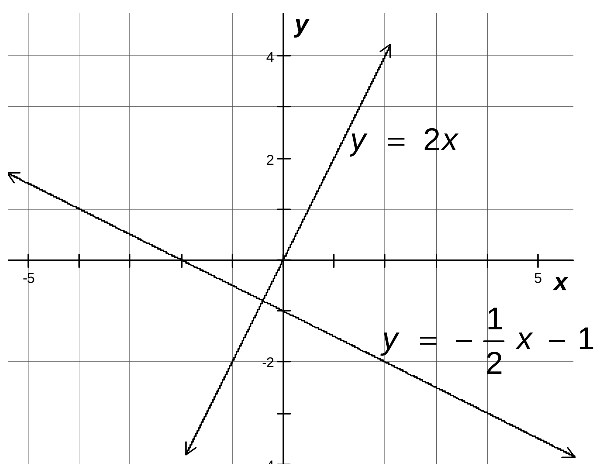
To review fractions and other basic concepts, visit http://migrant.net/migrant/MOM/index.html

Check choice **C** $y = -\frac{1}{2}x + \frac{3}{2}$.

$$2 = -\frac{1}{2}(-1) + \frac{3}{2}$$
$$2 = \frac{1}{2} + \frac{3}{2} = \frac{4}{2}$$

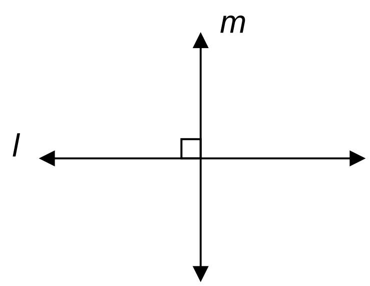
Since the point $(-1, 2)$ is a solution to the equation, the line passes through this point. This means choice **C**, $y = -\frac{1}{2}x + \frac{3}{2}$, is the answer.

As we have discovered, keeping the slope the same and changing the *y*-intercept produces a set of parallel lines. A set of lines with different slopes intersect. If two lines have slopes that are **negative reciprocals** of each other, they are **perpendicular**.



To find the **negative reciprocal** of a fraction, flip the fraction and change the sign in front of the number. For example, the negative reciprocal of $\frac{a}{b}$ is $-\frac{b}{a}$.

A whole number is a fraction with a 1 in the denominator. Thus, the negative reciprocal of 2 or $\frac{2}{1}$ is $-\frac{1}{2}$.

> Two lines are **perpendicular** if they intersect to form four right angles.
>
> 
>
>
> Line *l* is perpendicular to line *m*. We write this as,
>
> $\overleftrightarrow{l} \perp \overleftrightarrow{m}$.

Example

Which equation represents a line that is perpendicular to $y = \frac{2}{3}x + 5$, and goes through the point $(2, 0)$.

A $y = \frac{2}{3}x + 4$ **B** $y = -\frac{3}{2}x + 2$

C $y = \frac{3}{2}x - 3$ **D** $y = -\frac{3}{2}x + 3$

Solution

First, we can eliminate the choices that are not perpendicular. These are the lines that do not have a slope that is a negative reciprocal. The line $y = \frac{2}{3}x + 5$ has a slope of $\frac{2}{3}$ and its negative reciprocal is $-\frac{3}{2}$. Neither choice **A**, $y = \boxed{\frac{2}{3}}x + 4$, nor **C**, $y = \boxed{\frac{3}{2}}x - 3$, has a slope of $-\frac{3}{2}$.

~~**A** $y = \frac{2}{3}x + 4$~~

~~**C** $y = \frac{3}{2}x - 3$~~

Cross these choices out.

Check to see which of the remaining linear equation goes through the point $(2, 0)$ by substituting the corresponding values in for *x* and *y*.

Check choice **B** $y = -\frac{3}{2}x + 2$.

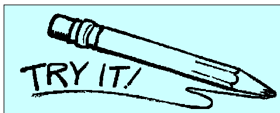
$$0 = -\frac{3}{2}(2) + 2$$
$$0 \neq -3 + 2$$

By process of elimination, choice **D** should be the answer. We will double check to see if this is true.

Check choice **D** $y = -\frac{3}{2}x + 3$.

$$0 = -\frac{3}{2}(2) + 3$$
$$0 = -3 + 3$$

Since the point $(2, 0)$ is a solution to the equation, the line passes through this point. This means choice **D**, $y = -\frac{3}{2}x + 3$, is the answer.



1) Which equation represents a line that is perpendicular to $y = -2x - 1$, and goes through the point $(0, 1)$?

A $y = 2x - 1$

B $y = \frac{1}{2}x + 1$

C $y = \frac{1}{2}x - 1$

D $y = -\frac{1}{2}x + 1$

2) Which equation represents a line that is parallel to $y = -x + 2$, and goes through the point $(1, 0)$?

A $y = x - 1$

B $y = -x - 1$

C $y = x$

D $y = -x + 1$

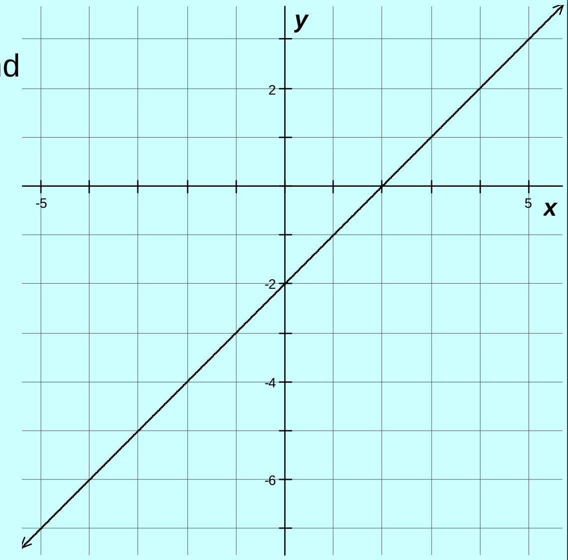
3) Which equation represents a line that is perpendicular to the given linear graph and goes through the point $(-1, -1)$?

A $y = -x - 2$

B $y = -x + 1$

C $y = -x$

D $y = x$



All of the linear equations we have worked with have been in $y = mx + b$ form. But, how do we graph a linear equation that is not in this form? To do so, we need to solve the equation for *y*.

Example

Rewrite the equation $2y - 4x = 5$ in $y = mx + b$ form.

Solution

This is very similar to solving equations with one variable. Our goal is to get *y* by itself. We need to remove the numbers and terms that are attached to *y*, using inverse operations.

$$2y - 4x = 5$$
$$\underline{+4x} \quad \underline{+4x}$$

Undo subtraction by adding

$$\frac{2y}{2} = \frac{4x + 5}{2}$$

Undo multiplication by dividing

$$y = \frac{4x}{2} + \frac{5}{2}$$

Since there are two terms in the numerator, we can rewrite this as two fractions. Use the same denominator, 2, for both.

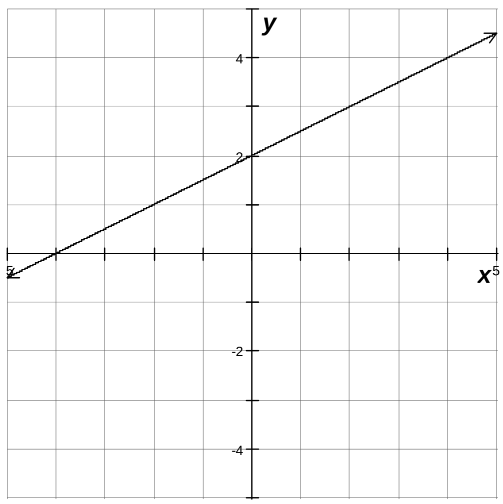
$$y = 2x + \frac{5}{2}$$

Any linear equation can be put into $y = mx + b$ form using algebra.

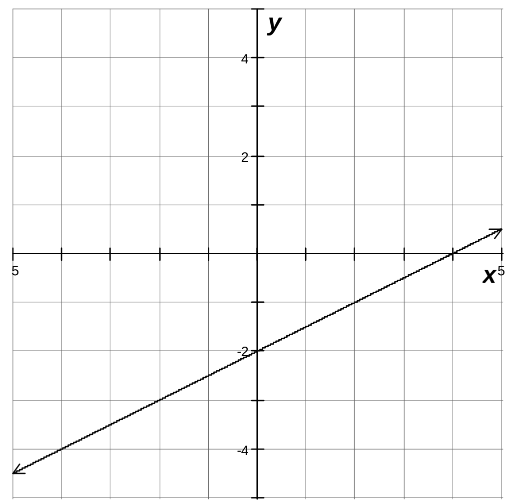
Example

Which graph best represents the equation $2x - 4y = -8$?

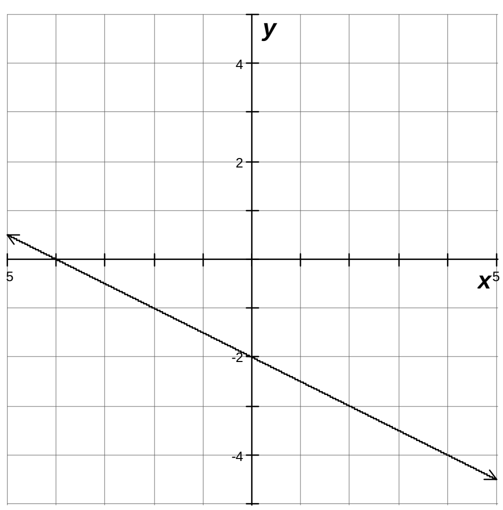
A



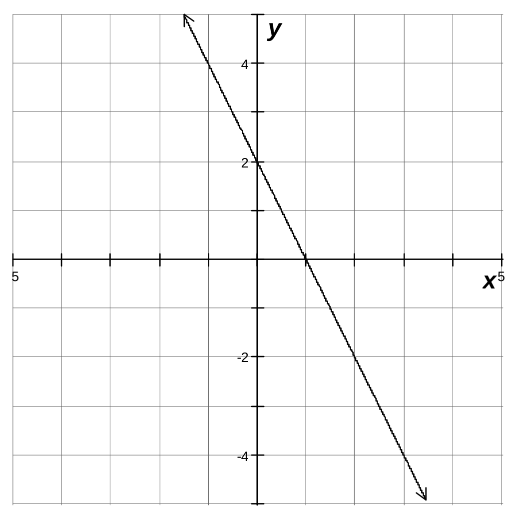
B



C



D



Solution

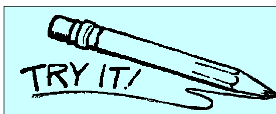
First, we need to put the equation $2x - 4y = -8$ in $y = mx + b$ form.

$$\begin{aligned} 2x - 4y &= -8 \\ -2x \quad\;\; &\quad -2x \\ \frac{-4y}{-4} &= \frac{-2x - 8}{-4} \\ y &= \frac{-2}{-4}x + \frac{-8}{-4} \\ y &= \frac{1}{2}x + 2 \end{aligned}$$

Problem Solving Tip

When multiplying or dividing, if the signs are the same, the product or quotient is positive. If the signs are different, it's negative.

Now we can determine which of these graphs has a *y*-intercept of 2 and a slope of $\frac{1}{2}$. Choice **A** and **D** are the only graphs with a *y*-intercept at 2. From these two, choice **A** has a positive slope. Therefore, choice **A** is the answer.



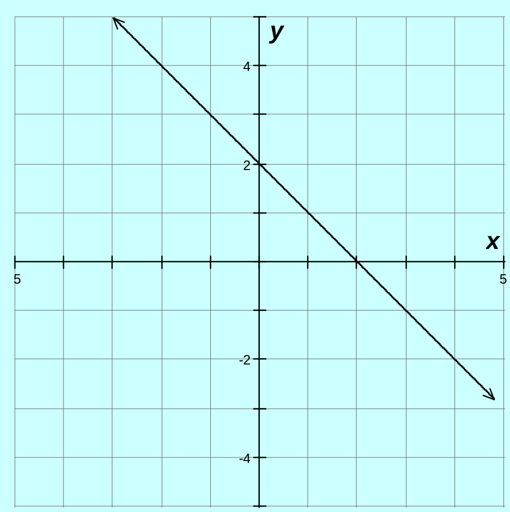
4) Which equation best represents the graph provided?

A $2x - 2y = 4$

B $4y - 2x = 1$

C $3y + 3x = 6$

D $y - x = 2$



5) Which equation is not a line perpendicular to $y = -2x$?

A $x - 2y = 4$

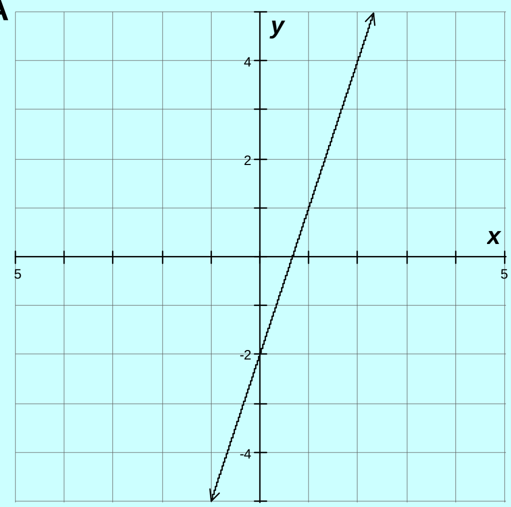
B $4y - 2x = -1$

C $2y - x = 6$

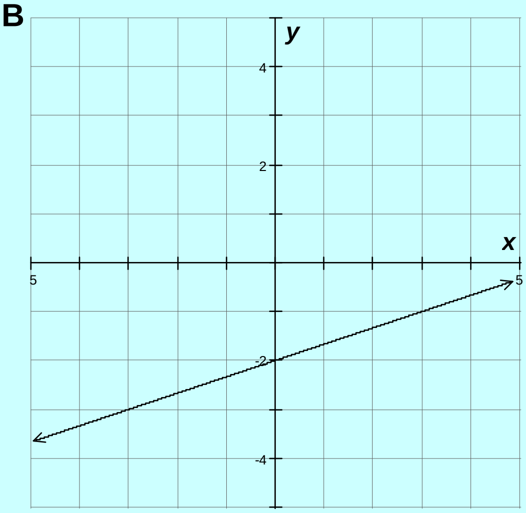
D $2y + x = 2$

6) Which of the following graphs represents a line perpendicular to $3y + x = 6$, and crosses through the point $(1,1)$?

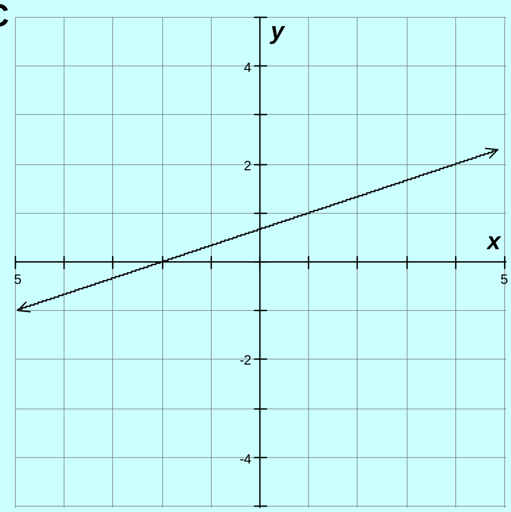
A



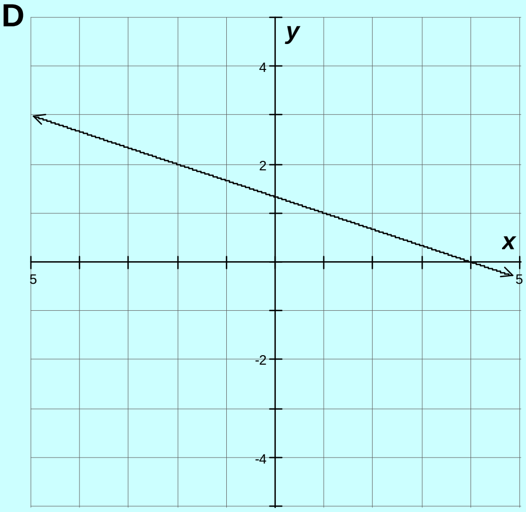
B



C



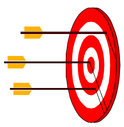
D



Review

Know these concepts:

1. Parallel lines have the same slope.
2. Perpendicular lines have slopes that are negative reciprocals of each other.
3. If an equation is not given in $y = mx + b$ form, you must solve for y algebraically.



Practice Problems
Lesson 10

Directions: Write your answers in your math journal. Label this exercise TAKS Review – Lesson 10.

1) Which of the following equations represents a line parallel to $y = 2x - 1$?

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

C $y = \frac{1}{2}x - 1$ **D** $y = x$

2) Which of the following equations represents a line perpendicular to $y = x - 17$?

A $y = x - 2$ **B** $y = x + 2$

C $y = -x - 1$ **D** $y = -\frac{1}{x} + 1$

3) Which of the following equations represents a line parallel to $3y = 2x - 1$?

A $6y - 3x = -1$ **B** $3y + 2x = 1$

C $\frac{2}{3}y = x - 1$ **D** $9y - 6x = 0$

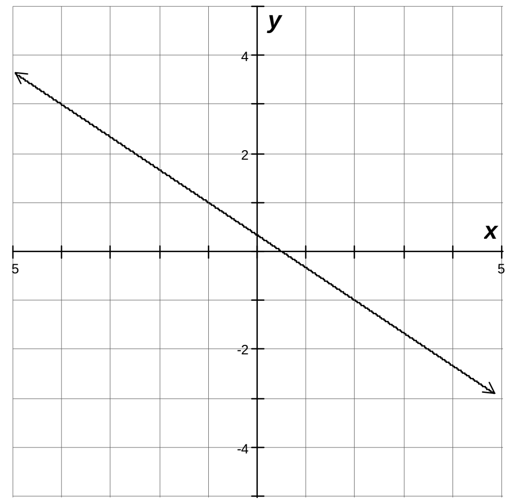
4) Which of the following equations represents a line parallel to the given graph?

A $2x = -3y + 2$

B $2x = 3y - 2$

C $3x = -2y$

D $3x = 2y + 6$



5) Which equation represents a line that is perpendicular to $2x - y = -x + 2$, and goes through the point $(2, -1)$?

A $y - 3x = 1$

B $y + 7 = 3x$

C $3y + x = -1$

D $3y - x = 1$

ANSWERS TO TRY IT

1) **B**

2) **D**

3) **A**

4) **C**

5) **D**

6) **A**

End of Lesson 10