INTERCEPTS AND SLOPES

ACT Math: Lesson and Problem Set

SKILLS TO KNOW

- How to find the slope of a line from two points.
- How to put any equation into slope intercept form, and from that, derive the slope or y-intercept
- How to find the equation of a line from two points or a point and a slope
- How to find the x- or y- intercept(s) of linear (and non-linear) equations
- How to use information about parallel or perpendicular lines in finding the equation of a line

When it comes to slopes, intercepts, and linear equations, you are expected to know just about everything you learned in Algebra 1—with less emphasis on actual methods of solving (you won't need point-slope form for example) or vocabulary, but full expectation of proficiency in the area of manipulation and problem solving.

SLOPE OF A LINE FROM TWO POINTS

SLOPE FORMULA

For points (x_1, y_1) and (x_2, y_2), $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

1. If you're given a **GRAPH** instead of points, **pluck points off the graph** and you can still use this formula. OR simply count RISE over RUN but remember downhill lines are negative, and uphill lines are positive.

2. You could also **program this one in your calculator.** More on that in the skills & hacks chapter.

What is the slope of the line containing the points $(10,7)$ and $(14,19)$ in the standard (x, y) coordinate plane?

A. -3 **B.** $-\dfrac{1}{3}$ **C.** $\dfrac{1}{3}$ **D.** 3 **E.** $\dfrac{26}{24}$

To solve this one, simply plug in your numbers into the slope formula.

Let points $(10,7) = (x_1, y_1)$ and $(14,19) = (x_2, y_2)$.

Then plug in and solve:

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{19-7}{14-10}$$

$$\frac{12}{4} = 3$$

Answer: **D**.

SLOPE INTERCEPT FORM

SLOPE INTERCEPT FORM

$$y = mx + b$$

Where m is the **slope** of the line, and b is the **y-intercept** of the line at point $(0,b)$.

You need to know what this means, and how to use it.

What is the slope-intercept form of $8x - 2y + 6 = 0$?

A. $y = -8x - 6$
B. $y = -8x + 6$
C. $y = 8x + 6$
D. $y = 4x + 3$
E. $y = 4x - 3$

If you're asked to put an equation in this form, <u>you must isolate the "y" value.</u>

$8x - 2y + 6 = 0$ Add $2y$ to both sides

$8x + 6 = 2y$ "Flip" the equation (put the y on the left)

$2y = 8x + 6$ Divide both sides by 2

$y = 4x + 3$

Answer: **D**.

Here's another example:

What is the slope of the line $\frac{y}{3} = \mathbf{x}$?

Here we can put the problem into slope intercept form again by isolating the y value. If we multiply both sides by 3 we get:

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

$$y = 3x$$

$$3 = m$$

The answer is 3.

EQUATION OF A LINE FROM TWO POINTS OR A POINT AND A SLOPE

Here you'll use the slope-intercept form to help again; Yes, you could memorize point-slope form, but ultimately, it's easier to just memorize one equation.

Which of the following is an equation for the line passing through $(2,2)$ and $(8,4)$ in the standard (x,y) coordinate plane?

A. $y=3x$ **B.** $y=3x-20$ **C.** $y=\frac{1}{3}x$ **D.** $y=\frac{1}{3}x+\frac{11}{3}$ **E.** $y=\frac{1}{3}x+\frac{4}{3}$

As you can see, the answers are all in slope intercept form. Even if they weren't, we could still use this method and then manipulate the equation to the other form (i.e. standard form, etc.) later.

First we find the slope:

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{4-2}{8-2}=\frac{2}{6}=\frac{1}{3}$$

Now we plug in that slope into $y=mx+b$:

$$y=\frac{1}{3}x+b$$

Finally, we plug in one of the pairs of numbers—it doesn't matter which pair you choose. I'll choose $(8,4)$:
That means $x=8$ and $y=4$. I simply substitute these into the equation above since we know that they are a solution, and in the process, I solve for b.

$$4=\frac{1}{3}(8)+b$$

$$b=4-\frac{8}{3}=\frac{12}{3}-\frac{8}{3}=\frac{4}{3}$$

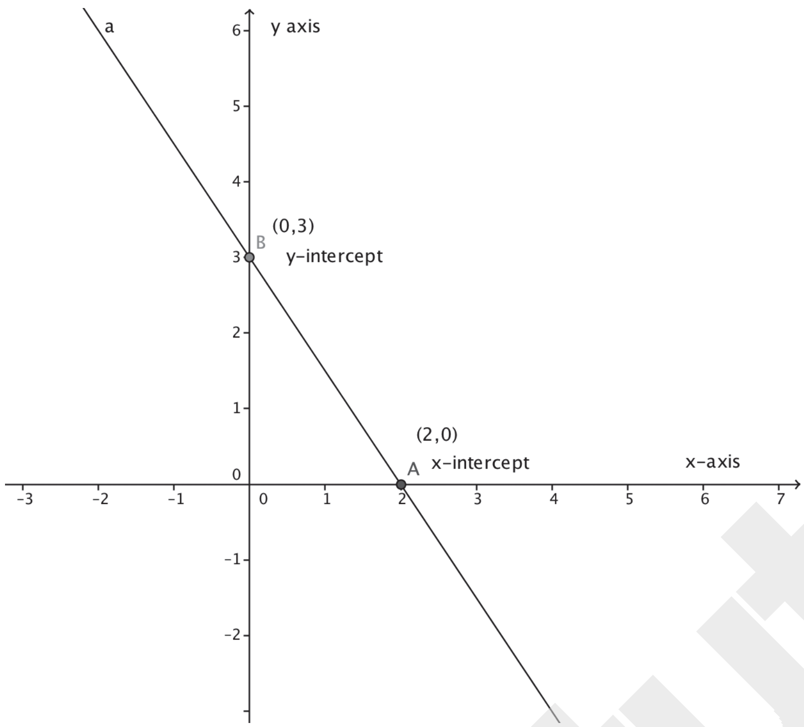
Upon finding $b=\frac{4}{3}$, I plug it back into our earlier equation: $y=\frac{1}{3}x+b$

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

Answer: **E**. At this point, if the answers are in a different form, you can manipulate the equation to match that form.

You can use simple calculator programs to help with problems such as this one.
See SupertutorTV.com/main/Calculator-Programs for more info.

X AND Y INTERCEPTS



Intercepts

Intercepts are the points at which your line, shape, or other element crosses through the y-axis (y-intercept) or x-axis (x-intercept).

The most common error that students make on intercept questions is mixing up the y-axis and x-axis. (I.e. when asked for an x-intercept, they put a y-intercept.)

The memory trick that I use is to think about "y-i" and "x-i."

I let the "i" stand for IS: it is IS something, not nothing (0).

If you are looking for a y-intercept, the y-is the number, and x=0 i.e. (0,3) gives the y-intercept.
If you are looking for an x-intercept, the x-is the number, and y=0 i.e. (2,0) gives the x-intercept.

If you tend to confuse these, the other trick you can pull is to quickly sketch a graph—look at the y (rhymes with high – up and down) and x (a"cross"(get it—x looks like a cross) – left to right) and figure out which you want and which value is 0. In general, if you are getting coordinate geometry questions wrong, you probably need to draw more often. Little sketches are quick and often a great strategy!

To find an intercept—you have a few options:

For the *y*-intercept: put the equation into slope-intercept form $\left(y = mx + b\right)$ and solve for b.

What is the y-intercept of $y = 2x + 4$?

Answer: 4.

This equation is already in slope intercept form, or $y = mx + \boldsymbol{b}$. Thus $b = 4$, and b stands for the y-intercept, so the answer is 4.

But what if you need the *x*-intercept? Or if it's a pain to put the equation in that form? Or you have a quadratic or insane looking polynomial!? In that case, plug in 0 for the appropriate variable (y-intercept—plug in 0 for x, x-intercept—plug in 0 for y) and solve for the remaining variable.

Find the y-intercept of $y = x^4 + x^3 + 2x - 7$

Remember, y-intercept means y-IS the number—so $x = 0$.
Plug in 0 and you get:

$$y = 0^4 + 0^3 + 2(0) - 7$$

$$y = -7$$

You can also solve intercept problems at times using your graphing calculator. If you have an equation you can graph, plug it in, and then hit “trace.” Look for the points where the function crosses the axis (**x=0** or **y=0**).

In the (x, y) coordinate plane, the x-intercept of the line is represented by:

A. -3 **B.** 3 **C.** 5 **D.** -5 **E.** $\frac{5}{3}$

If x “is” the number than y is zero. Plug in 0 for y and you get

$$0 = -3x + 5$$

$$-5 = -3x$$

$$\frac{5}{3} = x$$

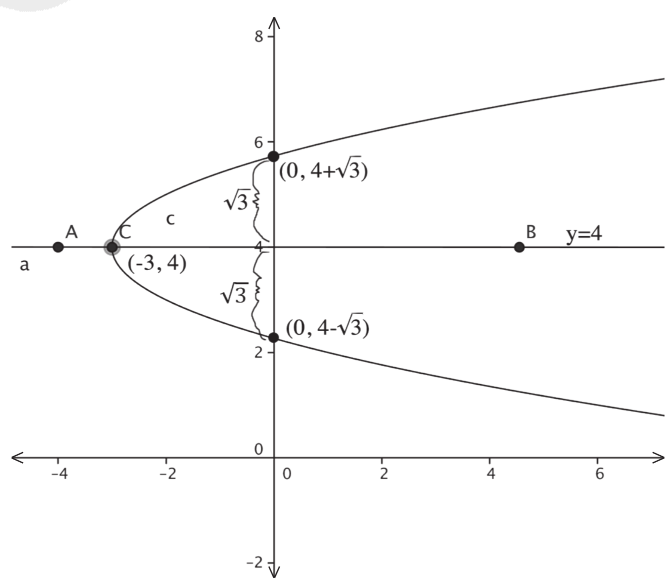
Answer: **E**.

A parabola with vertex $(-3, 4)$ and an axis of symmetry at $y = 4$ crosses the y-axis at $\left(0, 4+\sqrt{3}\right)$. At what other point, if any, does the parabola cross the y-axis?

A. $\left(0, 4-\sqrt{3}\right)$ **B.** $\left(0, -4-\sqrt{3}\right)$ **C.** $\left(0, -4+\sqrt{3}\right)$ **D.** No other point **E.** Cannot be determined from the given information

We could simply sketch a graph up front knowing the parameters, and use the idea of symmetry to find the point on the opposite side of the line of symmetry, the point $\left(0, 4+\sqrt{3}\right)$. Since the line of symmetry is at 4 you're looking above and below that line by $\sqrt{3}$. So $\left(0, 4-\sqrt{3}\right)$ is correct.

The correct answer is **A**.



This above method is probably the fastest—but you may not see it.

Another way to approach this problem is to memorize the standard vertex form of a parabola:

PARABOLA FORMULA

$$y = a(x-h)^2 + k \text{ OR } x = a(y-k)^2 + h$$

You probably deal with parabolas that are vertically oriented (the first equation) far more often, so this problem is a bit tough on that note alone.

We find out from the axis of symmetry at $y = 4$ that it's a horizontally facing parabola.. Y is how "high" a line is – so this is a horizontal line across a consistent "height" (high and y rhyme if that helps!).
And thus the parabola is symmetric about that horizontal line. So we need to use the 2nd equation.

We plug in $(-3,4)$ as our vertex at (h,k) and (x,y) our pair at $(0,4+\sqrt{3})$ and can solve this algebraically:

$x = a(y-k)^2 + h$	Plug in: $x = 0$, $y = 4+\sqrt{3}, h = -3$ and $k = 4$.
$0 = a(4+\sqrt{3}-4)^2 - 3$	Be sure not to confuse equations or variables— h always follows the x, k always corresponds to the y.
$0 = a\left(\sqrt{3}\right)^2 - 3$	The 4 and -4 cancel.
$0 = 3a - 3$	Square the $\sqrt{3}$ to get 3.
$3 = 3a$	Add 3 to both sides.
$1 = a$	Divide by 3.

Now that we know $a = 1$, and, again $h = -3$ and $k = 4$, we know the equation is:

$$x = 1(y-4)^2 - 3$$

Then we can:

A. Plug in "0" for x and solve for the other point that crosses through the y-axis

$0 = (y-4)^2 - 3$	
$3 = (y-4)^2$	Add 3 to both sides.
$\pm\sqrt{3} = y - 4$	Take the square root of both sides.
$4+\sqrt{3} = y$ or $4-\sqrt{3} = y$	Add 4 to both sides.

$(0, 4-\sqrt{3})$ is the point we don't have yet, so that is the answer.

OR

B. Graph on a graphing calculator and trace to the intersection point between the parabola and the y-axis.

Answer: **A**.

PARALLEL AND PERPENDICULAR LINES

Parallel lines share the same slope.

As such, if you know the slope or slope-intercept form of one line, and that another line is parallel to it, you can find its slope as well.

What is the slope of any line parallel to the *x*-axis in the (x, y) coordinate plane?

A. −1
B. 0
C. 1
D. Undefined
E. Cannot be determined from the given information

So this is a bit of a trick question, but let's think about what happens in a parallel line equation:

The "y" value (or height) of the equation is fixed. For example, $y = 6$ is a line parallel to the x-axis. What is its slope? Well it is the same as $y = 0x + 6$, right? So the slope is 0 and the answer is **A**!

I know it can be confusing to remember that horizontal lines have a slope of zero. Another way to think of this is with the slope equation—there is no rise, only run. That means the slope will be zero over some number.

Perpendicular lines have slopes that are opposite reciprocals of each other.

What is the slope of a certain line perpendicular to the line $4x + 8y = 20$ in the standard (x, y) coordinate plane?

A. -4 **B.** $-\frac{1}{2}$ **C.** $\frac{1}{2}$ **D.** 2 **E.** 4

$4x + 8y = 20$ First we must put the line into slope intercept form.

$8y = 20 - 4x$ Move x to the other side to isolate the variable y

$y = \frac{20}{8} - \frac{4}{8}x$ Divide both sides by 8.

$y = -\frac{x}{2} + \frac{5}{2}$ Use commutative property to keep the x next to the equal sign.

$y = -\frac{1}{2}x + \frac{5}{2}$

Now, from slope intercept form, we know the slope is $-\frac{1}{2}$.

Since perpendicular lines have slopes that are opposite reciprocals and the slope of this line is $-\frac{1}{2}$, the slope of the perpendicular line is 2.

Answer: **D**.

1. When $9x = 3y - 27$ is graphed in the standard (x, y) coordinate plane, what is the y-intercept?

A. 3
B. 6
C. 9
D. 12
E. 15

2. In the standard (x, y) coordinate plane, what is the x-intercept of the line expressed as $y = -\frac{x}{5} + 3$?

A. −15
B. −3
C. 3
D. 8
E. 15

3. Which of the following equations, when graphed in the standard (x, y) coordinate plane, would cross the x-axis at $x = -13$ and at $x = 7$?

A. $y = -5(x+13)(x-7)$

B. $y = -6(x+13)(x+7)$

C. $y = 2(x-13)(x-7)$

D. $y = 3(x-13)(x+7)$

E. $y = -3(x-13)(x-7)$

4. A parabola with vertex $(5,-9)$ and axis of symmetry at $x = 5$ crosses the x-axis at $\left(5-\sqrt{35},0\right)$. At what other point, if any, does the parabola cross the x-axis?

A. $\left(5+\sqrt{35},0\right)$

B. $\left(-5-\sqrt{35},0\right)$

C. $\left(-5+\sqrt{35},0\right)$

D. No other point

E. Cannot be determined from given information

5. What is the y-intercept of a line that contains the points $(5,-2)$ and $(3,2)$ in the standard (x, y) coordinate plane?

A. $\left(\frac{1}{2},0\right)$

B. $\left(0,-\frac{1}{2}\right)$

C. $(0,8)$

D. $(8,0)$

E. $(8,-8)$

6. What is the slope of the line containing the points $(15,8)$ and $(10,7)$ in the standard (x, y) coordinate plane?

A. $\frac{7}{3}$

B. $\frac{3}{5}$

C. $\frac{3}{5}$

D. 5

E. $\frac{1}{5}$

7. Points $A(-10,2)$ and $B(8,-5)$ lie in the standard (x, y) coordinate plane. What is the slope of $\overline{AB}$?

A. $-\frac{7}{18}$

B. $\frac{7}{18}$

C. $-\frac{3}{2}$

D. $\frac{3}{2}$

E. $\frac{2}{3}$

8. To check the slope of the roof of a house, an architect places an overlay of the standard (x,y) coordinate plane on the blueprint so the *x*-axis aligns with the horizontal on the blueprint. The line segment representing the side view of the roof goes through the points $(3,-2)$ and $(15,5)$. What is the slope of the roof?

A. $-\frac{1}{6}$
B. $-\frac{1}{4}$
C. 4
D. $\frac{7}{12}$
E. $\frac{12}{7}$

9. In the standard (x,y) coordinate plane, what is the slope of a line passing through the points $(-3,-4)$ and $(5,0)$?

A. -2
B. $-\frac{1}{2}$
C. $\frac{1}{2}$
D. $-\frac{7}{5}$
E. 2

10. What is the slope of the line through the points $(7,3)$ and $(12,9)$?

A. $\frac{10}{21}$
B. $\frac{12}{19}$
C. $\frac{5}{6}$
D. $\frac{6}{5}$
E. $\frac{21}{10}$

11. The graph of the line $6x = 4y - 20$ does NOT have any points in what quadrant(s) of the standard (x,y) coordinate plane below?

A. Quadrant I only
B. Quadrant II only
C. Quadrant III only
D. Quadrant IV only
E. Quadrants I and III only

12. For some real number k, the graph of the line of $y = (k-3)x + 13$ in the standard (x,y) coordinate plane passes through $(3,4)$. What is the slope of this line?

A. -9
B. -3
C. 0
D. 4
E. 9

13. Which of the following has the largest slope?

A. $y = 5x - 3$
B. $y = x + 12$
C. $y = 3x - \frac{5}{2}$
D. $2y + 18x = 15$
E. $3y = 2x - 10$

14. Lines a and b lie in the same standard (x,y) coordinate planes. The equation for line a is $y = 0.035x + 150$. The slope of line b is 0.01 less than that slope of line a. What is the slope of line b?

A. 0.0035
B. 0.025
C. 0.034
D. 0.135
E. 1.035

15. What is the slope of the line given by the equation $12x - 7y + 17 = 0$?

A. -7

B. $-\frac{12}{7}$

C. $-\frac{7}{12}$

D. $\frac{12}{7}$

E. 12

16. In the standard (x, y) coordinate plane, what is the slope of the line given by the equation $11x - 7y = 5$?

A. -7

B. $-\frac{11}{7}$

C. $\frac{7}{11}$

D. $\frac{11}{7}$

E. 11

17. What is the slope of the line represented by the equation $8y - 22x = 9$?

A. -22

B. $\frac{9}{8}$

C. $\frac{11}{4}$

D. 8

E. 22

18. When graphed in the standard (x, y) coordinate plane, the line $4x + 5y - 3 = 0$ has a slope of:

A. -4

B. $-\frac{4}{5}$

C. $\frac{4}{5}$

D. $\frac{5}{4}$

E. 4

19. The line with the equation $9x + 5y = 7$ is graphed in the standard (x, y) coordinate plane. What is the slope of this line?

A. $-\frac{9}{5}$

B. $-\frac{5}{9}$

C. $\frac{9}{5}$

D. $\frac{5}{9}$

E. $\frac{7}{5}$

20. For all $m \neq 0$, what is the slope of the line segment connecting $(-m, n)$ and $(m, -n)$ in the standard (x, y) coordinate plane?

A. 0

B. $-\frac{n}{m}$

C. $-\frac{m}{n}$

D. $2n$

E. Slope is undefined

21. In the standard (x,y) coordinate plane, if the x-coordinate of each point on a line is 3 more than $\frac{1}{4}$ its y-coordinate, the slope of the line is:

A. -4

B. -3

C. $\frac{1}{4}$

D. 3

E. 4

22. What is the slope-intercept form of $3x - y + 9 = 0$?

A. $y = -3x - 9$

B. $y = -3x + 9$

C. $y = 9x + 3$

D. $y = 3x + 9$

E. $y = 3x - 9$

23. The points $(-3,7)$ and $(0,9)$ lie on a straight line. What is the slope-intercept equation of the line?

A. $y = 3x - 9$

B. $y = \frac{2}{3}x + 10$

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

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

E. $y = -3x + 7$

24. The slope of the line with the equation $y = mx + b$ is less than the slope of the line with the equation $y = nx + b$. Which of the following statements *must* be true about the relationship between m and n?

A. $m \geq n$

B. $m > n$

C. $m \leq n$

D. $m < n$

E. $m + .5 \leq n$

25. As part of a lesson on slopes and equations, Mr. Hurwitz rolled a barrel at a constant rate along a straight line. His students recorded the distance (d), in feet, from a reference point at the start of the experiment and at 4 additional times (t), in seconds.

t	0	1	2	3	4
d	12	14.5	17	19.5	22

Which of the following equations represents this data?

A. $d = t + 12$

B. $d = \frac{5}{2}t + 7$

C. $d = \frac{5}{2}t + 12$

D. $d = 12t + \frac{5}{2}$

E. $d = 14.5t$

26. What is the slope of any line parallel to the y-axis in the (x,y) coordinate plane?

A. -1

B. 0

C. 1

D. Undefined

E. Cannot be determined from the given information

27. If the graphs of $y = \frac{5}{3}x - 7$ and $y = ax + 12$ are parallel in the standard (x,y) coordinate plane, then $a = ?$

A. -12

B. $-\frac{3}{5}$

C. 0

D. $\frac{5}{3}$

E. 12

28. When graphed in the standard (x, y) coordinate plane, the graph of which of the following equations is parallel to the x-axis?

A. $x = -7$
B. $x = -7y$
C. $x = y$
D. $y = -7$
E. $y = -7x$

29. What is the slope of any line parallel to the line $6x + 7y = 5$ in the standard (x, y) coordinate plane?

A. -6
B. $-\frac{6}{7}$
C. $\frac{6}{5}$
D. $\frac{7}{6}$
E. 6

30. The table below contains coordinate pairs that satisfy a linear relationship. What does a equal?

x	y
-4	-11
-2	-8
0	-5
2	-2
7	a

A. $\frac{11}{2}$
B. 2
C. $-\frac{11}{2}$
D. 0
E. 3

31. Chris is planning a party for his friend. He receives the following prices from the restaurant:

Number of Guests	Price
30	\$235
35	\$250
40	\$265
45	\$280
50	\$295

What equation, where x is the number of guests and y is the price in dollars, best fits the information in the table?

A. $y = 3x + 235$
B. $y = 3x + 145$
C. $y = 60x + 235$
D. $y = 30x + 235$
E. $y = 50x + 295$

32. What is the y-intercept of the line that contains the points $(-2,4)$ and $(3,1)$ in the standard (x, y) coordinate plane?

A. $\frac{14}{3}$
B. $-\frac{14}{3}$
C. $-\frac{14}{5}$
D. $-\frac{3}{5}$
E. $\frac{14}{5}$

33. What is the x-intercept of the line that passes through the point $(4,-7)$ and has a slope of $-\frac{1}{2}$?

A. 4
B. -10
C. 10
D. -5
E. 18

34. When $4x = 2y - 12$ is graphed in the standard (x, y) coordinate plane, what is the x-intercept?

A. -3
B. 3
C. 6
D. -6
E. -12

35. A parabola with vertex $(2,5)$ and an axis of symmetry at $x = 2$ crosses the y-axis at $(0,13)$. At what other point, if any, does the parabola cross the y-axis?

A. $(0,-13)$
B. $(4,-13)$
C. $(0,-9)$
D. No other point
E. Cannot be determine from the given information

36. The table below lists the number of volunteer organizations in a certain county in Nevada for the years 2001 through 2005. Which expression, using x as the number of years after 2001, best models the approximate number of volunteer organizations in that county?

Year	# Volunteer Orgs
2001	212
2002	217
2003	221
2004	226
2005	230

A. $\frac{9}{2}x + 212$
B. $\frac{9}{2}x + 2001$
C. $4x + 212$
D. $\frac{2}{9}x + 212$
E. $\frac{2}{9}x + 2001$

ANSWER KEY

1. C	**2. E**	**3. A**	**4. A**	**5. C**	**6. E**	**7. A**	**8. D**	**9. C**	**10. D**	**11. D**	**12. B**	**13. A**
14. B	**15. D**	**16. D**	**17. C**	**18. B**	**19. A**	**20. B**	**21. E**	**22. D**	**23. D**	**24. D**	**25. C**	**26. D**
27. D	**28. D**	**29. B**	**30. A**	**31. B**	**32. E**	**33. B**	**34. A**	**35. D**	**36. A**			

ANSWER EXPLANATIONS

1. **C**. We convert the equation into slope-intercept form: $y = 3x + 9$. The y-intercept is the constant in the equation, 9.

2. **E.** To find the x-intercept, set y equal to 0 and solve for x : $0 = -\frac{x}{5} + 3$. This becomes $\frac{x}{5} = 3$, so $x = 15$.

3. **A.** The equation that crosses the x-axis at $x = -13$ and $x = 7$ has roots that are equal to zero at both of those points, respectively. Thus, it must have $(x+13)$ and $(x-7)$ in its factorization. The only answer choice that has both is A.

4. **A**. Since the parabola has a vertical axis of symmetry, its second crossing must be as equidistant from the axis of symmetry to the first crossing, but on the right instead of the left. Thus, it must cross the x-axis a second time at $\left(5+\sqrt{35}, 0\right)$.

5. **C**. We find the slope of the line as the change in y over the change in x : $\frac{2-(-2)}{3-5} = -2$. We put this into the point-slope form using one of the given points: $2 = -2(3) + b$. From this, we can easily find that $b = 8$.

Since b represents the y-intercept, the y-intercept is $(0,8)$.

6. **E**. The slope of a line is the change in the y coordinate divided by the change in the x coordinate. Here, it is

$$\frac{8-7}{15-10} = \frac{1}{5}$$

7. **A.** The slope of a line is the change in the y coordinate divided by the change in the x coordinate. Here, it is:

$$\frac{2-(-5)}{-10-(8)} = -\frac{7}{18}$$

8. **D.** The slope of the roof is equal to the change in the vertical direction divided by the change in the horizontal direction. Thus, the slope of the roof is equal to $\frac{5-(-2)}{15-3} = \frac{7}{12}$.

9. **C**. The slope is the change in y over the change in x : $\frac{-4-0}{-3-5} = \frac{-4}{-8} \rightarrow \frac{1}{2}$.

10. **D**. The slope is the change in y over the change in x : $\frac{9-3}{12-7} = \frac{6}{5}$.

11. **D**. We change the formula into $4y = 6x + 20$, and divide by 4 on both sides to express it in slope-intercept form: $y = \frac{3}{2}x + 5$. We can graph this to see that it does not pass through quadrant IV.

12. **B.** The line passes through the y-intercept, $(0,13)$, and $(3,4)$. The slope is equal to the change in the y direction divided by the change in the x direction: $\frac{13-4}{0-3} \rightarrow \frac{9}{-3} \rightarrow -3$.

13. **A**. By transforming each equation into slope-intercept form, we can easily compare the slopes by comparing the coefficients of x in each formula. When we do this, we see that (A) has the largest slope, of 5.

14. **B**. The slope of a is the coefficient of x, 0.035. The slope of b is $0.035-0.01=0.025$.

15. **D**. Isolate the term that contains y by moving it to the other side: $7y=12x+17$. Then, isolate y by dividing by 7: $y=\frac{12}{7}x+\frac{17}{7}$. The slope is the coefficient of x in slope-intercept form: $\frac{12}{7}$.

16. **D.** Express the equation in slope-intercept form by isolating y. The equation becomes $7y=11x-5$, which simplified is $y=\frac{11}{7}x-\frac{5}{7}$. From this form we see that the slope is $\frac{11}{7}$.

17. **C.** Rewrite the equation and isolate y: $8y=22x+9$ becomes $y=\frac{22}{8}x+\frac{9}{8}$. Simplifying to $y=\frac{11}{4}x+\frac{9}{8}$, the slope is $\frac{11}{4}$.

18. **B**. Isolate y: $5y=-4x+3$ becomes $y=-\frac{4}{5}x+\frac{3}{5}$. The slope is the coefficient of x : $-\frac{4}{5}$.

19. **A**. Isolate y: $5y=-9x+7$ becomes $y=-\frac{9}{5}x+\frac{7}{5}$. The slope is the coefficient of x : $-\frac{9}{5}$.

20. **B**. The slope is the change in y over the change in x. Plugging into the slope formula yields $\frac{n-(-n)}{-m-m}=\frac{2n}{-2m}=-\frac{n}{m}$.

21. **E.** At every point on this line, $x=\frac{1}{4}y+3$. This can be expressed as $y=4x-12$. The slope is 4.

22. **D.** Isolating y is simple in this problem: $y=3x+9$.

23. **D**. The y-intercept is given as $(0,9)$. We can partially fill out the slope-intercept form of the line as $y=mx+9$. Using the slope formula, $m=\frac{9-7}{0-(-3)}=\frac{2}{3}$. Thus, $y=\frac{2}{3}x+9$.

24. **D**. The slope of the first equation, m, is less than the slope of the second equation, n. Thus, $m<n$.

25. **C**. The d-intercept of the equation (note: the d-axis is vertical and the t-axis is horizontal) is 12, as given in the table. The slope is the change in d over the change in t. We can use any 2 sets of points from the table. The slope is $\frac{17-12}{2-0}=\frac{5}{2}$. In slope-intercept form, the equation of the line is $d=\frac{5}{2}t+12$.

26. **D**. The slope of a vertical line is undefined. A line parallel to the y-axis in the (x,y) coordinate plain is vertical, so the slope of the line is undefined.

27. **D.** The slope of the second line is the coefficient of its x, a. The slope of the first line is the coefficient of its respective x, which is $\frac{5}{3}$. Since the lines are parallel, the slopes are equal. Thus, $a=\frac{5}{3}$.

28. **D**. A horizontal line is parallel to the x-axis. The general equation for a horizontal line is $y=b$ where b is some constant. The only line that fits this general equation is $y=-7$.

29. **B**. The slopes of parallel lines are equal. We can find the slope by expressing the line in slope-intercept form by isolating y. The equation becomes $7y=-6x+5$, which gives us $y=-\frac{6}{7}x+\frac{5}{7}$. The slope is $-\frac{6}{7}$.

30. **A**. The slope of a linear relationship is constant. From this, we can tell that $\frac{a-(-2)}{7-2}=\frac{-2-(-5)}{2-0}$. Simplifying $\frac{a+2}{5}=\frac{3}{2}$ gives us $a+2=\frac{15}{2}$. Isolating a: $a=\frac{15}{2}-2=\frac{11}{2}$.

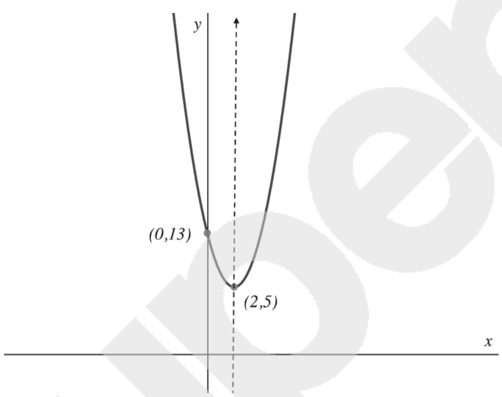
31. B. If x is the number of guests and y is the price in dollars, then we want to look at the table and find a function that would describe y in terms of x. We notice that each x-value increases by 5 while each y-value increases by 15. This means the slope of the function is $\frac{rise}{run}=\frac{15}{5}=3.$ So, $y=3x+b.$ Plugging in the first given point $(30,235)$ for values of x and y, we get $235=30(3)+b \rightarrow 235=90+b \rightarrow 145=b.$ So, the function that describes the given table is $y=3x+145.$

32. E. Find the slope given the two points: $m=\frac{y_2-y_1}{x_2-x_1}=\frac{1-4}{3-(-2)}=-\frac{3}{5}$. We can use the slope intercept form and one of the points given to find b, which essentially is the y-intercept. If $y=mx+b$, then $4=\left(-\frac{3}{5}\right)(-2)+b \rightarrow b=\frac{14}{5}.$

33. B. We could use point slope form, because we know both the slope and all but one coordinate value (since we are looking for the x-intercept, we know that the y-value of that point is 0 so we only need to find the x-value). Using point slope form: $y_2-y_1=m(x_2-x_1) \rightarrow (-7-0)=\left(-\frac{1}{2}\right)(4-x) \rightarrow -14=4-x \rightarrow x=-10$. Or, we could take a slightly longer route. First finding the point slope form: $y=mx+b \rightarrow -7=\left(-\frac{1}{2}\right)(4)+b \rightarrow b=-5.$ Then, plug in 0 for y: $0=\left(-\frac{1}{2}\right)(x)-5 \rightarrow 5=-\frac{x}{2} \rightarrow x=-10.$

34. A. The x-intercept is the point where y is 0, so if we plug in 0 for y we get: $4x=2(0)-12 \rightarrow 4x=-12 \rightarrow x=-3.$

35. D. Because the parabola has a vertical axis of symmetry, it must either be facing up or down, and not left or right. Upward and downward facing parabolas can only have 1 y-intercept. You can sketch the parabola to confirm.



36. A. We can represent the data we have as coordinate points in the form (x,y) where $x=$ the number of years after 2001 and $y=$ the number of volunteer organizations. Then, we have the points $(0,212)$, $(1,217)$, $(2,221)$, $(3,226)$, and $(4,230)$. Now, we look for a pattern so we can represent these points with a function. From $(0,212)$ to $(1,217)$, the x-value increased by 1 and the y-value increased by 5. From $(1,217)$ to $(2,221)$, the x-value increased by 1 and the y-value increased by 4. From $(2,221)$ to $(3,226)$, the x-value increased by 1 and the y-value increased by 5. From $(3,226)$ to $(4,230)$, the x-value increased by 1 and the y-value increased by 4. So, we see a general pattern where the x-value increases by 1 and the y-value increases by 4 or 5. Taking the average of 4 and 5, we can say that each y-value increases by approximately 4.5. So, the slope of the equation would be $\frac{4.5}{1}=\frac{9}{2}.$ The y-intercept would be the value of y where $x=0.$ So, that is $y=212.$ The function with slope $\frac{9}{2}$ and y-intercept 212 is $y=\frac{9}{2}x+212.$