Unit 5

Coordinate Geometry

Objectives

In this unit, you will:

- learn which coordinate geometry skills are tested on the ACT.
- learn which question types are used to test these concepts.
- practice using the 4 Questions to solve ACT-style coordinate geometry questions.

Unit Overview

Coordinate geometry is a major component of the ACT Math section. Students can use this to their advantage because many of these questions are fairly easy if the student is familiar with just a few formulas and concepts. This material is the focus of Unit 5.

Each page of the unit focuses on a particular coordinate geometry formula or concept, like finding the y-intercept or slope of a line. The formula appears in a box at the top of the page. A practice problem then follows, so that students can practice using the formula on an ACT-style question. The unit encourages students to use the 4 Questions for Strategic Problem Solving to solve each of the problems.

Teacher's Notes

- This page lists the skills that students need to solve the coordinate geometry problems on the ACT. Go over the list briefly and elicit definitions or examples. All of the material listed will be reviewed in this unit.
- Briefly go over the "anatomies" of a point and a slope-intercept equation.
- As the sidebar points out, the ACT deals almost exclusively with the graphs of points and linear equations. In the rare instances that questions involve other conic sections, the formulas for those curves will be provided. (Students who wish to familiarize themselves with these curves can find the formulas for circles, ellipses, and parabolas in the Math in a Nutshell reference at the end on Unit 1.)

Coordinate Geometry on the ACT

You will see about nine coordinate geometry problems on the Math section of the ACT. To solve these problems, you must be able to:

- find the distance between two points.
- graph a linear equation.
- find the midpoint of a line segment.
- write a linear equation based on a graph.
- find the slope of a line based on its equation or graph.
- find the y-intercept of a line from its equation or graph.
- identify parallel and perpendicular lines by their slopes.

This may seem like a lot of material, but really it boils down to being able to graph points and lines.

The Good News
Almost all coordinate geometry equations on the ACT will involve only points and lines. You will not need to deal with graphs of parabolas, ellipses, or other complex conic sections.

Anatomy of a Point

$(3, -4)$
↑ ↑
x-coordinate *y-coordinate*

Anatomy of a Line in Slope-Intercept Form

$y = \frac{2}{3}x + 6$
↑ ↑
slope *y-intercept*

Slope

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

For the equation $y = mx + b$ (y-intercept form), the slope is m.

For two points (x_1,y_1) and (x_2,y_2) slope $= \frac{y_2 - y_1}{x_2 - x_1}$

The slope is not affected by the y-intercept.

1. What is the slope of the line having the equation $2y + 4x + 5 = 0$?

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

❶ What do I want to know? ____________

❷ What do I know already? ____________

❸ What can I do with what I know? ____________

▸ Written in slope-intercept form, the equation is ____________

▸ So, the slope of the line is ________

The Standard Standard
ACT coordinate geometry problems often refer to "the standard (x,y) coordinate plane." That just means the same coordinate grid that you use in class.

Teacher's Notes

- Briefly review the boxed review information about slope.
- Solve problem 1 as a group, using the information at the top of the page and the Questions for Strategic Problem Solving.

Answers

1 B

❶ What is the slope of the line?

❷ $2y + 4x + 5 = 0$

The slope of a line in slope-intercept form is the coefficient of x.

❸ To solve the problem, the equation must be written in slope intercept form.

▸ Written in slope-intercept form, the equation is $\mathbf{y = -2x - \frac{5}{2}}$.

▸ So, the slope of the line is **−2**.

Teacher's Notes

- It is often useful to visually recognize the slopes of different lines. Briefly go over the boxed diagrams at the top of the page to review for students the graphic representations of positive, negative, 0, and undefined slopes.
- Give students a moment to read and work on problem 2, then solve the problem as a group using the Strategic Questions.

Answers

2 F

❶ Which of the following is true?

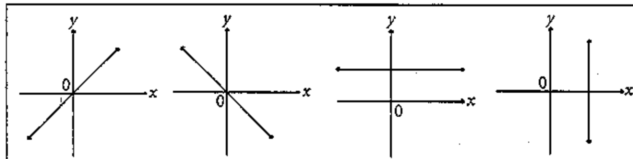
❷ The line passes through the points (–1,–1) and (2,3).

❸ The problem can be solved by finding the specific slope, or by making a quick sketch.

▸ For the points above, slope = $\frac{3-(-1)}{2-(-1)} = \frac{4}{3}$

The slope must be positive.

Alternately, students could make a quick sketch of the points and see that the line has a positive slope.



Problem Solving with a Glance
Once you know what positive and negative slopes look like, you can rule out several answer choices on slope problems almost instantly.

2. If line *m* passes through the points (–1,–1) and (2,3) in the standard (*x*,*y*) coordinate plane, which of the following is true of the slope of line *m*?

F. it *must* be positive
G. it *may* be negative
H. it *must* be negative
J. it *must* be undefined
K. it *must* be 0

❶ What do I want to know? ____________

❷ What do I know already? ____________

❸ What can I do with what I know? ____________

▸ For the points above, slope = $\frac{-}{-}$ = ____

Parallel and Perpendicular Lines

Parallel lines have the same slope.
Perpendicular lines have negative reciprocal slopes (like $-\frac{2}{1}$ and $\frac{1}{2}$).

3. If, in the standard (x,y) coordinate plane, the lines $3y = 4x - 5$ and $y = kx - 6$ are perpendicular, what is the value of k?
   - A. 4
   - B. $\frac{3}{4}$
   - C. $\frac{4}{3}$
   - D. $-\frac{3}{4}$
   - E. $-\frac{4}{3}$

How Many Solutions?
Perpendicular lines always have one common solution. Parallel lines have no common solution, unless they have the same y-intercept, in which case they are the same line and have infinitely many solutions.

❶ What do I want to know? ____________

❷ What do I know already? ____________

❸ What can I do with what I know? ____________

- ▸ The slope of the first line is ________
- ▸ The second line is perpendicular, so it must have a slope of ________
- ▸ k is therefore ________

KAPLAN

Teacher's Notes

- Briefly review the slope relations of parallel and perpendicular lines listed in the box at the top of the page.
- Solve problem 3 as a group, or let students work on it by themselves, and then review the problem together.

Answers

3 D

❶ What is the value of k?

❷ The lines are perpendicular.

Perpendicular lines have negative reciprocal slopes.

❸ Both lines must be expressed in slope-intercept form.

- ▸ The slope of the first line is $\frac{4}{3}$.
- ▸ The second line is perpendicular, so it must have a slope of $-\frac{3}{4}$.
- ▸ k is therefore $-\frac{3}{4}$.

TEACHER'S NOTES

- Review the boxed information about y-intercept with students, and then solve problem 4 as a group.
- Like many ACT problems, problem 4 does not directly ask for the y-intercept. Instead, it gives a description of a y-intercept. Students must know the meaning of the term, not just the formula for finding it.
- In the interest of clarity, only one method is given for finding the y-intercept of a line. It is also possible to substitute 0 for x and then solve for y. If you feel this method would be helpful for your students, you can solve problem 4 using both methods.

Answer

4 G

❶ At which value of y does the line intercept the y-axis?

- "At which value of y does the line intercept the y-axis" means **what is the y-intercept?**

❷ $x - 3y = 9$

❸

- The line should be rewritten in slope-intercept form.
- The equation written in slope-intercept form is $y = \frac{1}{3}x - 3$.
- So, the answer to the problem is **−3**.

y-Intercept

The **y-intercept** of a line is the *y-coordinate* at which the line intersects the y-axis.
For equation $y = mx + b$, the y-intercept is b.
The y-intercept is not affected by the slope.

Why Just y?
If the test asks you to identify the x-intercept, simply write the equation in terms of x. The x intercept of the equation $x = \frac{2}{3}y - 5$ is −5.

4. In the standard (x,y) coordinate plane, at which value of y does the line $x - 3y = 9$ intersect the y-axis?

F. −9
G. −3
H. $-\frac{1}{3}$
J. 3
K. 9

❶ What do I want to know? ____________

- "At which value of y does the line intersect the y-axis" means ____________

❷ What do I know already? ____________

❸ What can I do with what I know? ____________

- What can I do with what I know? ____________
- The equation written in slope-intercept form is ____________
- So, the answer to the problem is ____________

Graphing Equations

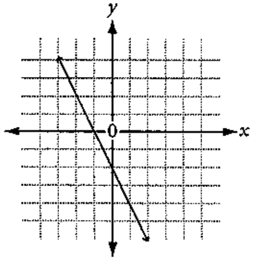
Since the ACT is a multiple-choice test, you will never be directly required to graph an equation. For many problems, however, it will be necessary to identify the graph of an equation.

To graph an equation:

- Write the equation in slope-intercept form.
- Then identify the y-intercept.
- From the y-intercept, move to the right according to the run, and then up or down according to the rise.
- A positive slope goes up, and a negative slope goes down. (Remember: slope = $\frac{\text{rise}}{\text{run}}$)

Will This Be on the Test?
You will never actually graph a line on the ACT, but the skills you need to graph a line—identifying slope and y-intercept—are key to answering many questions.

5. Which of the following is an equation for the graph in the standard (x, y) coordinate plane below?



A. $y = -2x - 1$

B. $y = -2x - 2$

C. $y = 2x - 1$

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

E. $y = \frac{-1}{2x-1}$

❶ What do I want to know? ________________

❷ What do I know already? ________________

❸ What can I do with what I know? ________________

Teacher's Notes

- As this page points out, students cannot be required to graph a line on a multiple-choice test. However, graphing a line or recognizing the graphic representation of an equation will often be a necessary skill to solve a problem.
- Review the method that is listed in bullet points for graphing a line. This method can be used as a reference while solving problem 5.
- Let students solve problem 5 individually, then review the answers together.

Answers

5 B

❶ Which of the following is an equation for the graph?

❷ Students should examine the graph, as well as review the method for graphing a line.

❸ The line has a slope of –2. (It drops 2 units for every unit it moves to the right.)

It has a y-intercept of –2.

The equation to describe the line is therefore $y = -2x - 2$.

Teacher's Notes

- This page reviews the distance formula and presents a typical ACT-style distance problem.
- The sidebar points out that the distance formula is a way of using the Pythagorean theorem. If you believe your students will benefit from this connection, you may want to present using the Pythagorean theorem as another version of the distance formula (or vice versa).
- Solve problem 6 as a group. (This problem also presents an opportunity to review factoring radicals.)

Answers

6 H

❶ What is the length of $\overline{AB}$?

❷ $A = (1,5), B = (7,1)$

❸ Students should use the distance formula.

$\text{Distance} = \sqrt{(7-1)^2 + (1-5)^2} =$

$\sqrt{(6)^2 + (-4)^2} =$

$\sqrt{52} = 2\sqrt{13}$

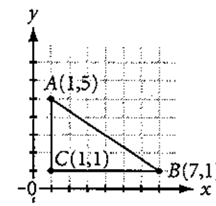
▸ Students could also view the problem as a right triangle with leg lengths 4 and 6.

Distance

Distance between two points (x_1, y_1) and $(x_2, y_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

That's Why They Call It Coordinate *Geometry*
If you compare the distance formula with the Pythagorean theorem, you can see that the distance formula is a way of finding the hypotenuse of a right triangle.

6. What is the length of $\overline{AB}$ in the diagram below?



F. 52
G. 12
H. $2\sqrt{13}$
J. 4
K. $\sqrt{13}$

❶ What do I want to know? ______

❷ What do I know already? ______

❸ What can I do with what I know? ______

Distance = √(−)²+(−)² =

√( )²+( )² =

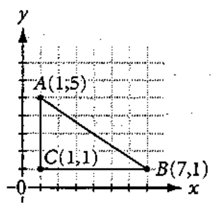
√ =

▸ How could you use the Pythagorean theorem to solve the problem?

Midpoint

Midpoint = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.
Or, (average of x_1 and x_2, average of y_1 and y_2).

7. What are the coordinates of the intersection of $\overline{AB}$ and its perpendicular bisector?



A. (1,1)
B. (4,3)
C. (3,4)
D. (3,1)
E. (1,4)

The Eliminator
On coordinate geometry problems with diagrams, you can often rule out a number of answer choices by "eyeballing" the diagram. This can help you make educated guesses if you are running out of time.

❶ What do I want to know? ______

▸ What is a bisector? ______

▸ Where does a bisector intersect a line segment? ______

❷ What do I know already? ______

❸ What can I do with what I know? ______

midpoint = $\left(\frac{\ \ +\ \ }{2}, \frac{\ \ +\ \ }{2}\right)$ = (,)

▸ Could you make an "eyeball" guess to eliminate any of the answer choices?

Teacher's Notes

- This page reviews the formula for finding the midpoint of a line and presents a practice problem.
- Many students find it helpful to think of a midpoint as an average of the two endpoints, rather than memorizing the distance formula.
- If your students are familiar with the midpoint formula, they could work on this problem individually or in small groups. If they are having trouble, solve the problem as a group.

Answers

7 B

❶ What are the coordinates of the intersection of $\overline{AB}$ and its perpendicular bisector?

▸ A bisector divides a line segment into two equal segments.

▸ at its midpoint

❷ $A = (1,5), B = (7,1)$

❸ Students should use the midpoint formula.
midpoint = $\left(\frac{\mathbf{1+7}}{2}, \frac{\mathbf{5+1}}{2}\right)$ = **(4,3)**

▸ Students could probably look at the diagram and eliminate most or all of the wrong answer choices.

TEACHER'S NOTES

- On the ACT, it is important for students to understand that a line is a graphic representation of all the number pairs that satisfy an equation. Likewise, the intersection of two lines represents the number pair or pairs that satisfy both equations. Many of the tougher coordinate geometry questions depend on this understanding.
- Read through the text at the top of the page to review this concept.
- Then, review the boxed information and solve problem 8 as a group.

Answer

8 F

❶ What is the value of k.

❷ $y = 2x - 5$ and $-3y = kx - 2$

- The lines that represent the equations are parallel.

❸ If the lines are parallel, they have the same slope.

- The slope of the lines is 2.
- $\frac{k}{-3} = 2$, so $k = -6$.

Solving Two Equations with Graphing

Points on a line represent number pairs that satisfy an equation, and a line represents all the points that satisfy an equation. For two equations, the intersection of their lines represents the number pair that satisfies both equations. This number pair is sometimes called "the solution of the system of equations."

For a system of two linear equations:
intersecting lines (different slope) = 1 solution
parallel lines (same slope) = no solution
coincident lines (same line) = infinite solutions

Parallel vs. Coincident
Both parallel and coincident lines have the same slope. Parallel lines have different y-intercepts, while coincident lines have the same y-intercept, and therefore are the same line.

8. If the system of equations $y = 2x - 5$ and $-3y = kx - 2$ has no solutions, what is the value of k?

F. -6
G. -2
H. $-\frac{1}{2}$
J. 2
K. 6

❶ What do I want to know? ____________

❷ What do I know already? ____________

- What do you know about two equations with no common solution? ____________

❸ What can I do with what I know? ____________

- If the lines are parallel, what is the slope of both lines? ____________
- What is the value of k? ____________

Guided Practice

Solve the coordinate geometry problems below by asking the 4 Questions. Some of the steps have been completed already.

1. Line t in the standard (x,y) coordinate plane has y-intercept −3 and is parallel to the line having the equation $3x - 5y = -4$. Which of the following is an equation for line t?

   A. $y = -\frac{3}{5}x + 3$

   B. $y = -\frac{5}{3}x - 3$

   C. $y = \frac{3}{5}x + 3$

   D. $y = \frac{5}{3}x + 3$

   E. $y = \frac{3}{5}x - 3$

Problem Solving
Coordinate geometry questions on the ACT often require you to use reasoning to get to a solution.

❶ What do I want to know?

It is underlined above.

❷ What do I know already?

Line t is parallel to $3x - 5y = -4$

Line t has y-intercept −3.

❸ What can I do with what I know?

If line t is parallel to $3x - 5y = -4$,

the two lines will have ________ slope.

$3x - 5y = -4$ written in slope-intercept form is ________.

So, line t has a slope of ________.

The equation for line t is ________.

❹ Is that what I want to know? Am I done?

Teacher's Notes

- Solve the Guided Practice problems as a group, using the 4 Questions for Strategic Problem Solving.

Guided Practice Answers

1 E

❸ If line t is parallel to $3x - 5y = -4$, the two lines will have **the same** slope.

$3x - 5y = -4$ written in slope-intercept form is $\mathbf{y = \frac{3}{5}x + \frac{4}{5}}$.

So, line t has a slope of $\mathbf{\frac{3}{5}}$.

The equation for line t is $\mathbf{y = \frac{3}{5}x - 3}$.

Teacher's Notes

- For the sake of consistency, this page suggests putting the equation in slope-intercept form before plugging in the x-coordinate. As in finding the y-intercept, it is not necessary to do so. If you feel your students would benefit, you may wish to also demonstrate solving the problem without expressing the equation in slope-intercept form.

Guided Practice Answers

2 G

❶ What is the y-coordinate?

❸ When I rewrite the equation in slope-intercept form, I get $y = \frac{3}{2}x - 2$.

When I plug the x-coordinate into the equation, y is **7**.

Plug and Go
Some problems that look like complex coordinate geometry questions really just require you to plug in one of the given variables to find other variable.

2. The equation $3x - 2y = 4$ can be graphed in the standard (x,y) coordinate plane. What is the y-coordinate of the point on the graph whose x-coordinate is 6?

   F. 11
   G. 7
   H. 5
   J. 3
   K. −11

❶ What do I want to know? ______

❷ What do I know already?

The point has x-coordinate 6.

The point will be on the line $3x - 2y = 4$.

The point is a solution of the equation of the line, so the x- and y-coordinates will make a true statement when plugged into the equation.

❸ What can I do with what I know?

When I rewrite the equation in slope-intercept form,

I get ______.

When I plug the x-coordinate into the equation,

y is ______.

❹ Is that what I want to know? Am I done?

3. The midpoint of the line segment $\overline{AC}$ in the standard (x,y) coordinate plane has coordinates (4,8). The (x,y) coordinates of A and C are (4,2) and $(4,s)$, respectively. What is the value of s?

A. 4
B. 5
C. 10
D. 12
E. 14

❶ What do I want to know? ____________

❷ What do I know already?

The midpoint has coordinates ____________.

The endpoints have coordinates (4,s) and ____________.

❸ What can I do with what I know?

For the endpoint, s is the ________ coordinate.

____

❹ Is that what I want to know? Am I done?

Meet Me Halfway
If two points have the same x- or y-coordinate, the midpoint will have that coordinate also. All you have to do is average the other coordinates of the endpoints to get to the answer.

Guided Practice Answers

3 E

❶ What is the value of s?

❷ The midpoint has coordinates **(4, 8).**

The endpoints have coordinates $(4, s)$ and **(4, 2)**.

❸ What can I do with what I know?

For the endpoint, s is the **y-coordinate.**

8 is the average of 2 and s.

$$8 = \frac{2+s}{2}$$

$$s = 14$$

Teacher's Notes

- Give students 4 minutes to solve these problems, then review the problems as a group.

Independent Practice Answers

1 B

After covering the material in this unit, this should be a quick, easy problem.

2 K

Parallel lines have the same slope.

3 B

Like the ACT, this problem requires students to use their knowledge to draw logical inferences.

4 F

The hint points out that the distance in this problem is the difference in *y*-coordinates.

Independent Practice

Solve the problems below. Be sure to ask the 4 Questions.

1. What is the slope of the line determined by the equation $5x + 3y = 13$?

   A. -15
   B. $-\frac{5}{3}$
   C. $-\frac{3}{5}$
   D. $\frac{3}{5}$
   E. $\frac{5}{3}$

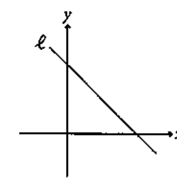
HINT *To write the equation in slope-intercept form, solve for y.*

2. Which of the following systems of equations does NOT have a solution?

   F. $x + 36 = 19$, $3x + y = 6$
   G. $x + 3y = 19$, $x - 3y = 13$
   H. $x - 3y = 19$, $3x - y = 7$
   J. $x - 3y = 19$, $3x + y = 6$
   K. $x + 3y = 6$, $3x + 9y = 7$

HINT *What is the slope relation of lines that have no solution?*

3. Line ℓ is graphed in the standard (x,y) coordinate plane as shown below. If the equation for line ℓ is written in the form $y = mx + b$, which of the following is true about m and b?

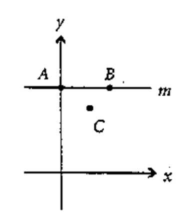


   A. m and b are both positive.
   B. m is negative and b is positive.
   C. m is positive and b is negative.
   D. either m or b must equal 0.
   E. m and b are both negative.

HINT *Look at the line. Are the slope and y-intercept positive or negative?*

4. In the standard (x,y) coordinate plane shown in the figure below, points A and B lie on line m, and point C lies below it. The coordinates of points A, B, and C are (0,5), (5,5), and (3,3), respectively. What is the shortest distance from point C to line m?

   F. 2
   G. $2\sqrt{2}$
   H. 3
   J. $\sqrt{13}$
   K. 5



HINT *The distance will be the difference in y-coordinates.*

Unit 5 ReKAP

Fill in the blanks to complete the sentences below.

- In the point (2,3), _______ is the *x*-coordinate.
- In the line $y = -5x - 2$, _______ is the slope and _______ is the *y*-intercept.
- Slope is _______ over _______.
- Vertical lines have an _______ slope, while horizontal lines have a slope of _______.
- _______ lines have the same slope, while _______ lines have slopes that are negative reciprocals.
- A system of two equations with no common solution is represented by _______ lines.
- Lines that have the same slope and *y*-intercept are called _______ lines.

Teacher's Notes

- Complete this exercise quickly as a group or have students complete it after class.

ReKAP Answers

- In the point (2,3), **2** is the *x*-coordinate.
- In the line $y = -5x - 2$, **–5** is the slope and **–2** is the *y*-intercept.
- Slope is **rise** over **run**. (or **change in *y* over change in *x*.**)
- Vertical lines have an **undefined** slope, while horizontal lines have a slope of **0**.
- **Parallel** lines have the same slope, while **perpendicular** lines have slopes that are negative reciprocals.
- A system of two equations with no common solution is represented by **parallel** lines.
- Lines that have the same slope and *y*-intercept are called **coincident** lines.

Teacher's Notes

- Give students 10 minutes to complete this Test Practice. Then go over the answers as a group.
- Alternately, students can complete the Test Practice on their own, and then the class can go over the answers and explanations as a group later. If students do complete the Test Practice on their own, remind them to time themselves, and to take no more than 10 minutes.
- The answer choices for questions 8 and 9 are erroneously reversed. Have students switch the answer choices for these two questions.

Test Practice Answers

1 E

Again, students may benefit from thinking of the midpoint as the average of the coordinates.

2 J

Students who recognize this as a 3:4:5 triangles should solve this problem very quickly.

3 D

Here, students must keep straight the signs of the terms.

4 K

Students should immediately recognize that the correct answer must have a negative coefficient of *x*, and so eliminate (F), (H), and (J).

Test Practice

Solve each problem below, and choose the correct answer.
You are permitted to use your calculator on this test.

1. In the standard (x,y) coordinate plane, points P and Q have coordinates $(2,3)$ and $(12,-15)$, respectively. What are the coordinates of the midpoint of $\overline{PQ}$?

A. $(6,-12)$
B. $(6,-9)$
C. $(6,-6)$
D. $(7,-9)$
E. $(7,-6)$

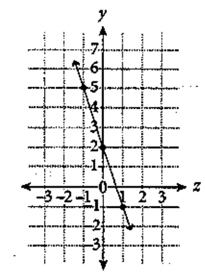
2. How many units apart are the points $P(-1,-2)$ and $Q(2,2)$ in the standard (x,y) coordinate plane?

F. 2
G. 3
H. 4
J. 5
K. 6

3. If $x = -5$, then $2x^2 - 6x + 5 = ?$

A. −15
B. 15
C. 25
D. 85
E. 135

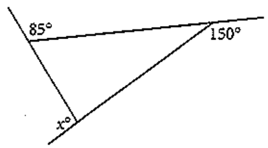
4. Which of the following is an equation for the graph in the standard (x,y) coordinate plane below?



F. $y = 3x - 2$
G. $y = -3x + 2$
H. $y = 2x + \frac{1}{2}$
J. $y = \frac{1}{3}x + 2$
K. $y = -\frac{1}{3}x + 2$

KAPLAN

5. In the figure below, what is the value of x?



A. 105°
B. 115°
C. 125°
D. 245°
E. 255°

6. For all x, $3x^2 \cdot 5x^3 = ?$

F. $8x^5$
G. $8x^6$
H. $15x^5$
J. $15x^6$
K. $15x^8$

7. In the standard (x,y) coordinate plane, line m is perpendicular to the line containing the points (5,6) and (6,10). What is the slope of line m?

A. -4
B. $-\frac{1}{4}$
C. $\frac{1}{4}$
D. 4
E. 8

8. For his newspaper delivery route, Francis can deliver 45 papers in 50 minutes. How many papers can he deliver in 60 minutes?

F. –15
G. –10
H. – 8
J. – 4
K. 10

9. The line that passes through the points (1,1) and (2,16) in the standard (x,y) coordinate plane is parallel to the line that passes through the points (–10,–5) and (a,25). What is the value of a?

A. 9
B. 45
C. 50
D. 54
E. 60

10. If the lengths, in inches, of all three sides of a triangle are integers, and one side is 7 inches long, what is the least possible perimeter of the triangle, in inches?

F. 9
G. 10
H. 15
J. 21
K. 24

Test Practice Answers

5 C

Although most diagrams on the ACT are drawn to scale, students may occasionally see a problem like this one, which is not.

6 H

This problem could be solved by Picking Numbers if students are stuck.

7 B

This problem involves two distinct stages, and so is somewhat time-consuming.

8 D (54)

Errata: The answer choices for question 8 and 9 are erroneously reversed.

9 H (–8)

Errata: The answer choices for question 8 and 9 are erroneously reversed.

10 H

The sum of any two sides of a triangle must be greater than the remaining side. Therefore, the sum of the two remaining sides of this triangles must be at least 8. The perimeter, therefore, must be at least 15 inches long.