TOPIC OVERVIEW

Topic D — Introduction to Slope

Slope, Rate of Change, and the y-Intercept





This overview guide contains...

The topic calendar — every objective and scheduled assessment through the Standards Mastery Check

Vocabulary — the terms you must build into your artifacts

Check Your Understanding problem sets — an extra tool to monitor your progress. Completing all questions is not required, but a guide kept up with, completed in full, and turned in at the end of the quarter raises your Standards Mastery Check score by **5%**. Answer keys for every question are posted on the class website.

SMC 1 Study Guide — fifteen questions in the same forms, and the same proportions, as the Standards Mastery Check on Tuesday, October 6

Since this guide contains so much foundational information vital to success in this course, it is **essential** to keep up with it. It's THE **most important document** needed for success.

Topic Calendar

Monday, September 21st – Tuesday, October 6th

WEEK 7 SEPTEMBER 21–25 — Public Presentations · Improve Dallas · Friday, Sep 25 through Friday, Oct 2

ARTIFACT 11 · Slope and Similar Triangles

BLOCK 1

MON–TUE, SEP 21–22

I can complete a statement comparing the slopes of segments formed by points on the same line using similar right triangles shown on a coordinate plane and justify the comparison. **8.4A**

I can create a proportion comparing side lengths of segments to show that the slopes of segments formed by points on the same line are equal, given similar triangles shown on a coordinate plane. **8.4A**

I can create a graph of a proportional relationship with a unit rate for which an equivalent rate must be calculated using the given fractional rate values. **8.4B**

ARTIFACT 12 · Calculating Slope and Rate of Change

BLOCK 2

WED–THU, SEP 23–24

I can calculate a slope given a graph with an integral rate of change. **8.4C**

I can determine the rate of change given a table where the change in the independent variable is not constant. **8.4C**

Performance Task 1.4 · Angle Relationships
in class Wed–Thu, Sep 23–24 · revisions due Wednesday, Oct 7

WEEK 8 SEPTEMBER 28–OCTOBER 2 — Mid-Unit Assessment revisions due Tuesday, Sep 29 · SMC 1 review begins

ARTIFACT 13 · Slope and y-Intercept

BLOCK 3

MON–TUE, SEP 28–29

I can determine slope and y-intercept given a graph or table of a real-world linear function, and explain its meaning. **8.4C**

REVIEW

WED–THU

SEP 30–OCT 1

Review for SMC 1: the Study Guide, Mathia, and practice in the test's formats.

Performance Task 1.5 · Connecting Similar Triangles to Slope & Slope/y-Intercept
in class Friday, Oct 2 · also due this day: Q1 Mathematical Process, Weeks 7–9

WEEK 9 OCTOBER 5–9 — Wed, Oct 7: PT 1.4 revisions and the Q1 Mathia End-of-Quarter Check due · Fri, Oct 9: Fall Break

Q1 Standards Mastery Check — Mathematics
Tuesday, Oct 6 · 15 questions · 8.4B, 8.4C, 8.5A, 8.3A, 8.3B, 8.3C, 8.8D, 8.10A, 8.10C

Vocabulary

All of these terms must be eventually added to at least one artifact (Artifact 11, 12, and/or 13!)

slope the steepness of a line: the change in y divided by the change in x between any two points on the line, $\frac{y_2-y_1}{x_2-x_1}$

rate of change how much y changes for each 1 unit of x; on a line the rate of change is the slope, and it is the same between any two points

change in x, change in y the horizontal and vertical differences between two points: $x_2 - x_1$ and $y_2 - y_1$

unit rate a rate for 1 unit of the second quantity (miles per 1 minute); on a graph through the origin, the unit rate is the slope

proportional relationship y is a constant times x, written $y = kx$; its graph is a straight line through the origin

constant of proportionality the number k in $y = kx$; it is the unit rate, and it is the slope of the line

origin the point $(0, 0)$, where the two axes cross

y-intercept the point where a line crosses the y-axis, $(0, b)$; the value of y when $x = 0$

initial value the starting amount in a real-world situation, before any change; the y-intercept

linear relationship a relationship with a constant rate of change; its graph is a straight line, and it can be written $y = mx + b$

slope-intercept form, $y = mx + b$ an equation of a line in which m is the slope and b is the y-intercept

similar right triangles right triangles with the same angle measures; any two right triangles drawn on the same line with legs along the grid are similar, so vertical leg ÷ horizontal leg is the same for both

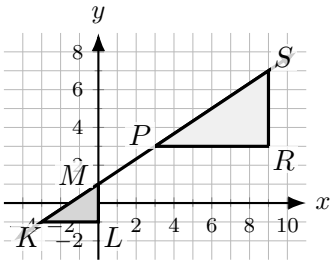
independent variable, dependent variable x is the input (independent); y is the output that depends on x

Check Your Understanding

Answer keys for every question are posted on the class website.

Questions 1–5 cover Artifact 11 (Slope and Similar Triangles)

1. Triangle KLM and triangle PRS are similar right triangles. Which proportion can be used to show that the slope of $\overline{KM}$ is equal to the slope of $\overline{PS}$?



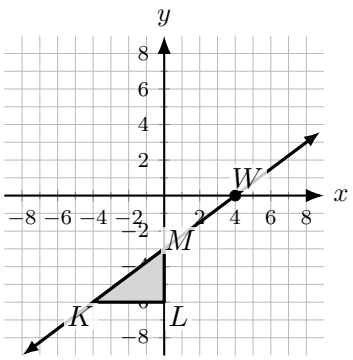
(A) $\dfrac{ML}{KL} = \dfrac{SR}{PR}$

(B) $\dfrac{KL}{ML} = \dfrac{SR}{PR}$

(C) $\dfrac{KM}{KL} = \dfrac{PS}{PR}$

(D) $\dfrac{ML}{KL} = \dfrac{PS}{SR}$

2. The line on the coordinate grid includes the hypotenuse of right triangle KLM. Right triangle UVW is similar to right triangle KLM, and vertex W is at (4, 0). The slopes of the hypotenuses of the two triangles are equal. Which ordered pair could be the coordinates of vertex U?



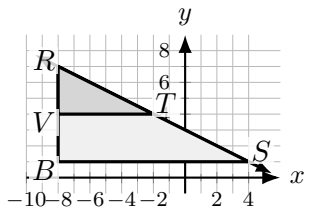
(A) (8, 3)

(B) (8, 4)

(C) (−4, 6)

(D) (0, 3)

3. Triangle RVT and triangle RBS are similar right triangles. Which proportion represents the slope of the line containing R, T, and S?



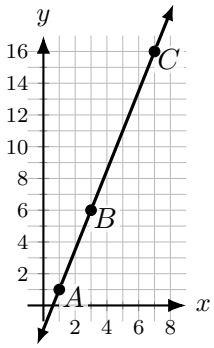
(A) $\dfrac{4-7}{-2-(-8)} = \dfrac{1-7}{4-(-8)}$

(B) $\dfrac{-2-(-8)}{4-7} = \dfrac{1-7}{4-(-8)}$

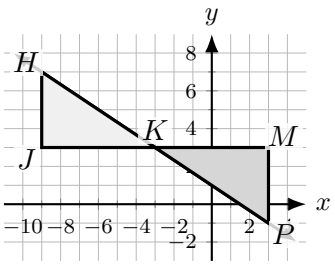
(C) $\dfrac{4-7}{-2-(-8)} = \dfrac{1-7}{-8-4}$

(D) $\dfrac{4-7}{-2-(-8)} = \dfrac{7-1}{4-(-8)}$

4. Points $A(1, 1)$, $B(3, 6)$, and $C(7, 16)$ lie on the line shown. Draw the right triangle whose hypotenuse is $\overline{AB}$ and the right triangle whose hypotenuse is $\overline{BC}$, with the legs along the grid lines. Then write a proportion, using the side lengths of the two triangles, that shows the slope of $\overline{AB}$ is equal to the slope of $\overline{BC}$. Explain why the two triangles must be similar.



5. Triangle HJK and triangle KMP are similar right triangles. The coordinates of all the vertices are integers. Which statement is true about the slope of $\overline{HK}$ and the slope of $\overline{KP}$?



(A) The slope of $\overline{HK}$ is less than the slope of $\overline{KP}$, because the ratio of the change in y-values of the endpoints to the change in x-values of the endpoints is less for $\overline{HK}$ than it is for $\overline{KP}$.

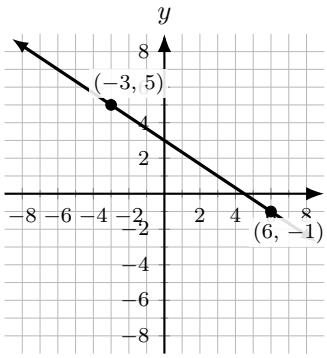
(B) The slope of $\overline{HK}$ is equal to the slope of $\overline{KP}$, because the ratio of the change in y-values of the endpoints to the change in x-values of the endpoints is the same for $\overline{HK}$ as it is for $\overline{KP}$.

(C) The slope of $\overline{HK}$ is greater than the slope of $\overline{KP}$, because the ratio of the change in y-values of the endpoints to the change in x-values of the endpoints is greater for $\overline{HK}$ than it is for $\overline{KP}$.

(D) The relationship between the slope of $\overline{HK}$ and the slope of $\overline{KP}$ cannot be determined, because the triangles are congruent.

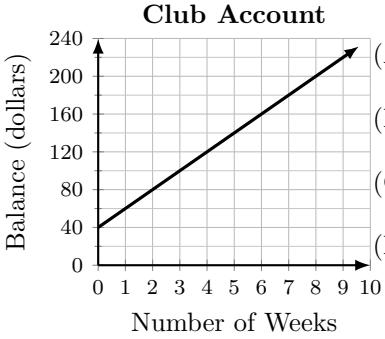
Questions 6–9 cover Artifact 12 (Calculating Slope and Rate of Change)

6. The graph of a linear relationship is shown on the coordinate grid. What are the slope and the y-intercept of the line?



(A) slope $= -\frac{3}{2}$, y-intercept $= 5$
(B) slope $= -\frac{2}{3}$, y-intercept $= 3$
(C) slope $= -\frac{3}{2}$, y-intercept $= 3$
(D) slope $= -\frac{2}{3}$, y-intercept $= 5$

7. The line graphed on the coordinate grid can be used to determine the balance of a school club's account after different numbers of weeks of collecting dues. Which statement best describes the slope of the graphed line?



(A) The club collects \$20 in dues each week.
(B) The club started with \$20 in its account.
(C) The club collects \$40 in dues each week.
(D) The club collects \$25 in dues each week.

8. The table shows a linear relationship between the variables x and y. What are the slope and the y-intercept of this linear relationship? Write ONE number from the bank in each box. Not all numbers will be used.

x	y
−10	−6
−5	−4
5	0
15	4

Bank: -6 | -2 | 0 | $\frac{2}{5}$ | $\frac{5}{2}$ | 5

Slope: ☐

y-intercept: (☐ , ☐)

9. A school library adds the same number of books each week. The table shows the linear relationship between x, the number of weeks, and y, the number of books in the library. How many books did the library have at the start?

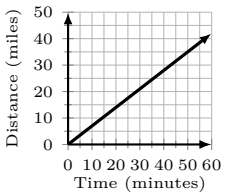
Weeks, x	Books, y
3	262
6	298
10	346
15	406

(A) 12
(B) 226
(C) 250
(D) 262

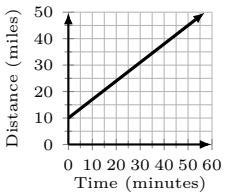
Questions 10–11 cover Artifact 13 (Slope and y-Intercept)

10. A delivery drone flies 21 miles in 30 minutes. Which graph has a slope that best represents the number of miles per minute the drone flies?

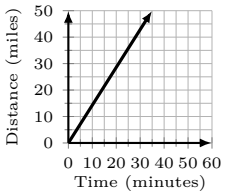
(A)



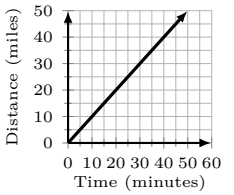
(C)



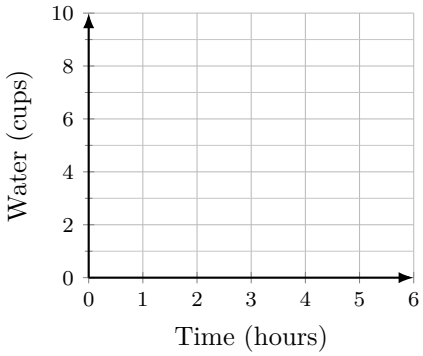
(B)



(D)



11. A faucet drips $\frac{3}{8}$ cup of water every $\frac{1}{4}$ hour. Find the number of cups that drip in 1 hour. Then graph the relationship between x, the number of hours, and y, the number of cups, on the axes.

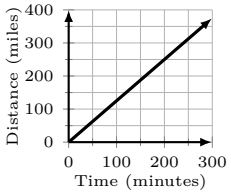


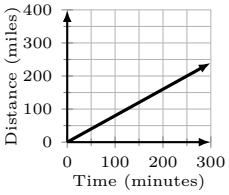
SMC 1 Study Guide

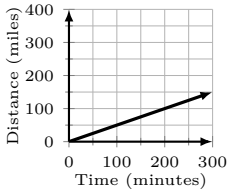
Tuesday, October 6 · keys on the class website

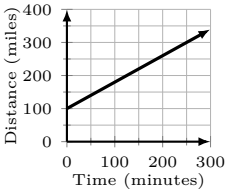
Fifteen questions in the forms and proportions of the Standards Mastery Check. A question you miss tells you which artifact to reread.

1. A freight train travels 200 miles in 250 minutes. Which graph has a slope that best represents the number of miles per minute the train travels?

(A)


(C)


(B)


(D)


2. The table shows a linear relationship between the variables x and y. What are the slope and the y-intercept of this linear relationship? Write ONE number from the bank in each box. Not all numbers will be used.

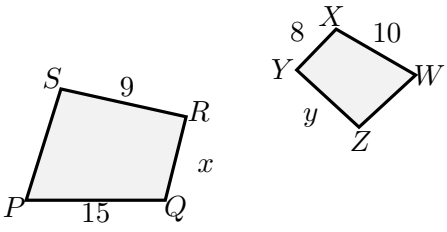
x	y
-16	-10
-6	-5
4	0
14	5

Bank: -4 | -2 | 0 | $\frac{1}{2}$ | 2 | 4

Slope: ☐

y-intercept: (☐ , ☐)

3. Quadrilateral $PQRS$ is similar to quadrilateral $WXYZ$. Based on the information in the diagram, which proportion must be true?



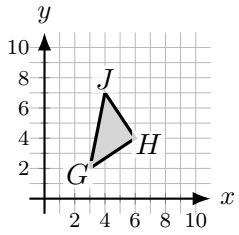
(A) $\frac{x}{8} = \frac{9}{y}$

(B) $\frac{x}{8} = \frac{y}{9}$

(C) $\frac{15}{x} = \frac{8}{10}$

(D) $\frac{15}{9} = \frac{x}{y}$

4. Triangle GHJ is dilated with the origin as the center of dilation to create triangle $G'H'J'$. Vertex H' is located at (15, 10). Which rule best describes this dilation?



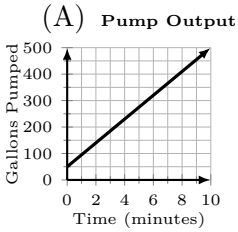
(A) $(x,\, y) \to \left(\frac{5}{2}x,\, \frac{5}{2}y\right)$

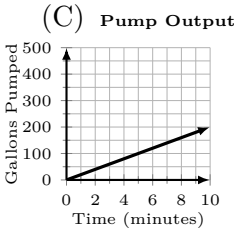
(B) $(x,\, y) \to \left(\frac{2}{5}x,\, \frac{2}{5}y\right)$

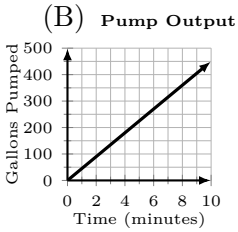
(C) $(x,\, y) \to (x + 9,\, y + 6)$

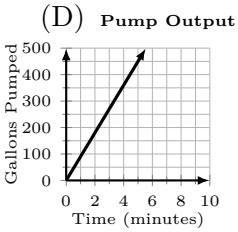
(D) $(x,\, y) \to (5x,\, 5y)$

5. A pump moves 900 gallons of water every 20 minutes. Which graph best represents the relationship between x, the number of minutes, and y, the number of gallons pumped?

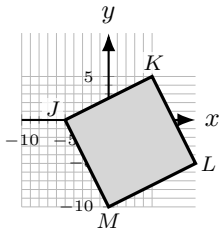
(A)


(C)


(B)


(D)


6. Quadrilateral $JKLM$ is shown on the coordinate grid. It will be dilated with the origin as the center of dilation using the rule $(x,\, y) \to \left(\frac{2}{5}x,\, \frac{2}{5}y\right)$ to create quadrilateral $J'K'L'M'$. Write ONE choice from the bank in each box. Not all choices will be used.



Bank: $\frac{2}{5}$ | $\frac{5}{2}$ | $\frac{4}{25}$ | complementary to | supplementary to | congruent to

Each side length of quadrilateral $J'K'L'M'$ is ☐ the corresponding side length of quadrilateral $JKLM$.

Each angle measure of quadrilateral $J'K'L'M'$ is ☐ the corresponding angle measure of quadrilateral $JKLM$.

7. Triangle DEF is reflected across the x-axis to form triangle $D'E'F'$. Which rule best describes this reflection?

(A) $(x,\, y) \to (-x,\, y)$

(B) $(x,\, y) \to (x,\, -y)$

(C) $(x,\, y) \to (y,\, -x)$

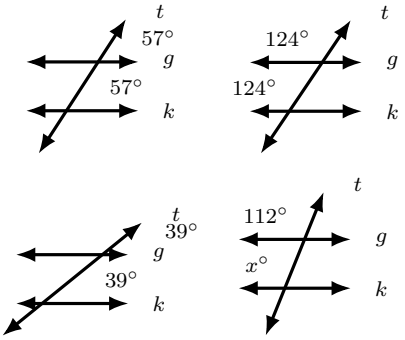
(D) $(x,\, y) \to (-y,\, x)$

8. A candle burns at a constant rate. The table shows the linear relationship between x, the number of minutes the candle has burned, and y, the height of the candle in centimeters. Based on the information in the table, which statement is correct?

Minutes, x	Height (centimeters), y
5	23.5
12	20
20	16
30	11

(A) The initial height of the candle was 23.5 centimeters.
(B) The initial height of the candle was 26 centimeters.
(C) The candle burns 3.5 centimeters each minute.
(D) The candle burns 4.7 centimeters each minute.

9. In each diagram, line g is parallel to line k, and line t intersects lines g and k. Based on the diagrams, which statement about x is true?



(A) The value of x is 180, because the labeled angles in each diagram are supplementary and the sum of the measures of supplementary angles is 180 degrees.
(B) The value of x is 90, because the labeled angles in each diagram are complementary and the sum of the measures of complementary angles is 90 degrees.
(C) The value of x is 68, because the sum of the measures of the labeled angles in each diagram is 180 degrees.
(D) The value of x is 112, because the labeled angles in each diagram are congruent.

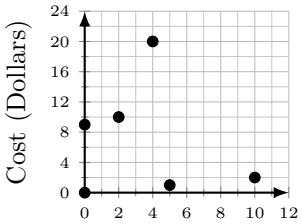
10. Trapezoid $JKLM$ is rotated 90° clockwise about the origin of a coordinate plane to create trapezoid $J'K'L'M'$. Which rule best describes this transformation?

(A) $(x, y) \rightarrow (x, -y)$
(B) $(x, y) \rightarrow (-x, y)$
(C) $(x, y) \rightarrow (-y, x)$
(D) $(x, y) \rightarrow (y, -x)$

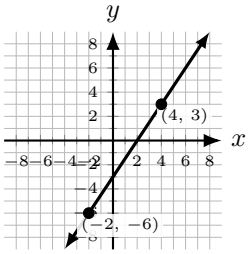
11. The coordinates of the vertices of triangle ABC are $A(6, 3)$, $B(9, 6)$, and $C(3, 9)$. Triangle ABC is dilated by a scale factor of $\frac{2}{3}$ with the origin as the center of dilation to create triangle $A'B'C'$. If (x, y) represents the location of any point on triangle ABC, which algebraic rule best describes this transformation?

(A) $(x, y) \rightarrow \left(\frac{3}{2}x, \frac{3}{2}y\right)$
(B) $(x, y) \rightarrow \left(x + \frac{2}{3}, y + \frac{2}{3}\right)$
(C) $(x, y) \rightarrow \left(\frac{2}{3}x, \frac{2}{3}y\right)$
(D) $(x, y) \rightarrow (x - 2, y - 1)$

12. A coach spends \$45 to buy 9 water bottles for the team. Each bottle costs the same amount. Circle the THREE points on the graph that best represent the relationship between the number of bottles purchased and the money spent.

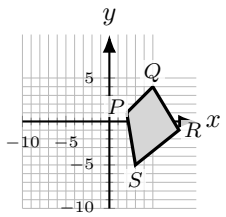


13. The graph of a linear function is shown on the coordinate grid. What is the slope of this linear function?



(A) -3
(B) $\frac{2}{3}$
(C) $\frac{3}{2}$
(D) 3

14. Quadrilateral $PQRS$ is reflected across the y-axis on the coordinate grid to form quadrilateral $P'Q'R'S'$. Which statement is true?



(A) The side lengths of quadrilateral $P'Q'R'S'$ are shorter than the corresponding side lengths of quadrilateral $PQRS$.
(B) The orientation of quadrilateral $P'Q'R'S'$ is the same as the orientation of quadrilateral $PQRS$.
(C) The angle measures of quadrilateral $P'Q'R'S'$ are congruent to the corresponding angle measures of quadrilateral $PQRS$.
(D) The area of quadrilateral $P'Q'R'S'$ is greater than the area of quadrilateral $PQRS$.

15. Triangle ABC is translated 5 units up and 7 units to the left on a coordinate grid to create triangle $A'B'C'$. Write a rule that describes this transformation. Write ONE choice from the bank in each box. Not all choices will be used.

$x - 7$	$x + 7$	$y - 5$	$y + 5$	$x - 5$
$x + 5$	$y - 7$	$y + 7$	$7x$	$5y$

$(x, y) \rightarrow (\square, \square)$