Virginia SOL Algebra 1 Summer Workbook

8 Weeks of Practice, Mixed Review & Answer Explanations

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Algebra 1 Summer Workbook

This workbook keeps Algebra 1 skills active during summer with a steady routine students can actually finish.

Each week moves from four focused practice days to one mixed review day. Students revisit equations, functions, graphs, systems, polynomials, quadratics, exponentials, statistics, and modeling with short Quick Reviews and teaching answer explanations.

For families and teachers

Use one workbook page per day, about 15–20 minutes. Let students try first, then use explanations as the teaching step after missed or uncertain problems.

For students

Show your algebra, label graphs, and correct missed problems in pencil. The goal is to start the next course with Algebra 1 feeling familiar.

How to Use This Workbook

The page order is the plan.

Move through the workbook one day at a time. Each week has four focused practice days and one mixed review day, so students practice both the skill and the decision-making needed to choose a method.

Practice days	Read the Quick Review, study the example, and complete each workbook section with organized algebra steps.
Mixed review day	Work through the Friday mixed review without looking back at the lesson title first. Choose the method from the problem.
Check answers	Read the explanation for every missed, guessed, or confusing problem. Correct the work before moving on.
Extra support	If a skill still feels shaky, redo one similar problem the next day before starting the new page.

Keep it short

Most pages should take about 15–20 minutes. Stop before practice turns into guessing.

Show thinking

Use equations, substitutions, graph labels, tables, or short explanations when a problem needs reasoning.

Fix mistakes

A corrected mistake is useful review. The answer key is written to reteach, not only to score.

My Summer Workbook Progress

Check off each practice day and write your Friday mixed review score.

This workbook belongs to: _____

Week	Day 1	Day 2	Day 3	Day 4	Mixed Review
1	☐	☐	☐	☐	_____ / ____
2	☐	☐	☐	☐	_____ / ____
3	☐	☐	☐	☐	_____ / ____
4	☐	☐	☐	☐	_____ / ____
5	☐	☐	☐	☐	_____ / ____
6	☐	☐	☐	☐	_____ / ____
7	☐	☐	☐	☐	_____ / ____
8	☐	☐	☐	☐	_____ / ____

Reflection Notes

After any mixed review, write the question number, what you noticed, and one comment that will help you next time. Use this space for problems you missed, guessed on, or want to remember.

Algebra 1 Reference Sheet

High-yield formulas and rules for summer review

Real Numbers

Natural: $1, 2, 3, \ldots$

Whole: $0, 1, 2, 3, \ldots$

Integers: $\ldots, -2, -1, 0, 1, 2, \ldots$

Rational: fractions; decimals terminate or repeat.

Irrational: decimals do not terminate or repeat.

$\sqrt{\text{perfect square}}$ *is rational.*

Properties

Commutative: $a + b = b + a,\ ab = ba$

Associative: $(a + b) + c = a + (b + c)$

Distributive: $a(b + c) = ab + ac$

Identity: $a + 0 = a,\ a \cdot 1 = a$

Inverse: $a + (-a) = 0,\ a \cdot \frac{1}{a} = 1$

Like terms have matching variable parts.

Exponents

$a^m \cdot a^n = a^{m+n}$

$\frac{a^m}{a^n} = a^{m-n}$

$(a^m)^n = a^{mn}$

$(ab)^n = a^n b^n$

$a^0 = 1$ *for* $a \neq 0$

$a^{-n} = \frac{1}{a^n}$

Radicals

$\sqrt{ab} = \sqrt{a}\sqrt{b}$

$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Simplify by factoring out perfect squares.

$\sqrt{50} = \sqrt{25 \cdot 2} = 5\sqrt{2}$

For real even roots, the radicand is nonnegative.

Check whether the final form is exact or decimal.

Equations

Use inverse operations on both sides.

Clear fractions by multiplying by the LCD.

Distribute before combining like terms.

Variables on both sides: move variables first.

Identity: true statement, infinitely many solutions.

Contradiction: false statement, no solution.

Inequalities

Solve like equations.

Flip the sign when multiplying or dividing by a negative.

$x < a$*: open circle, shade left.*

$x \geq a$*: closed circle, shade right.*

Compound AND: overlap.

Compound OR: union of two parts.

Functions

Function: each input has exactly one output.

Domain = allowed inputs.

Range = possible outputs.

$f(a)$ *means substitute* a *for* x*.*

Rate of change: $\frac{\Delta y}{\Delta x}$

Vertical line test checks graphs.

Linear

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Slope-intercept: $y = mx + b$

Point-slope: $y - y_1 = m(x - x_1)$

Standard: $Ax + By = C$

Parallel lines have the same slope.

Perpendicular: $m_1 m_2 = -1$

Systems

Solutions are intersections.

Substitution: solve one equation, plug in.

Elimination: align terms, add or subtract.

One solution: different slopes.

No solution: parallel lines.

Infinitely many: same line.

Polynomials

Add/subtract by combining like terms.

Multiply monomials: multiply coefficients, add exponents.

FOIL works for binomials.

Degree = greatest exponent.

Standard form orders powers from greatest to least.

Leading coefficient controls end behavior with degree.

Factoring

GCF first.

Difference of squares: $a^2 - b^2 = (a + b)(a - b)$

Perfect square: $a^2 \pm 2ab + b^2 = (a \pm b)^2$

$x^2 + bx + c$*: numbers multiply to* c*, add to* b*.*

$ax^2 + bx + c$*: numbers multiply to* ac*, add to* b*.*

Zero product: if $ab = 0$*, then* $a = 0$ *or* $b = 0$*.*

Quadratics

Standard: $y = ax^2 + bx + c$

Vertex: $y = a(x - h)^2 + k$

Factored: $y = a(x - r_1)(x - r_2)$

Axis: $x = -\frac{b}{2a}$

Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Discriminant: $b^2 - 4ac$

Exponential

Model: $y = ab^x$

a *= initial value.*

Growth: $b > 1$*.*

Decay: $0 < b < 1$*.*

Percent growth: $b = 1 + r$*.*

Percent decay: $b = 1 - r$*.*

Sequences

Arithmetic: add common difference d*.*

$a_n = a_1 + (n - 1)d$

Geometric: multiply common ratio r*.*

$a_n = a_1 r^{n-1}$

Recursive rules need a starting value.

Table of Contents

Your 8-week summer review plan

A little review each day keeps math fresh!

WEEK 1

Foundations and Equations

Sample workbook pages from the full 8-week practice plan.

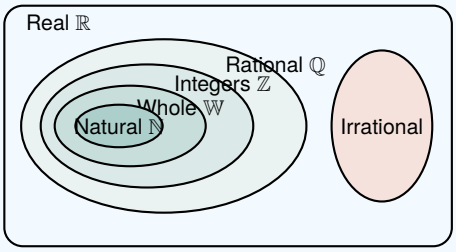
In This Week

Day 1	*The Real Number System and Properties*
Day 2	*Laws of Exponents*
Day 3	*Square Roots and Radicals*
Day 4	*Solving Linear Equations*
Mixed Review	*Foundations and Equations Mixed Review*

Day 1 The Real Number System and Properties

SKILL SNAPSHOT

This version emphasizes classifying each number into *every* real-number subset that applies. The rational-number sets are nested, while irrational numbers sit beside the rationals inside the real numbers.



- $\mathbb{N} \subset \mathbb{W} \subset \mathbb{Z} \subset \mathbb{Q} \subset \mathbb{R}$.
- 0 is whole, integer, rational, and real, but not natural in this book.
- Negative integers are not whole or natural.
- Perfect-square radicals simplify to rational numbers; non-perfect-square radicals are irrational.
- Properties of real numbers justify rewriting expressions without changing their value.

Remember: When the problem says "all applicable sets," list the smallest set first and then every larger set that contains it.

Use the Venn diagram idea.

1. List every subset for 0.

2. List every subset for $-\sqrt{36}$.

3. List every subset for $\sqrt{49}$.

4. List every subset for $\frac{14}{7}$.

5. List every subset for -3.25.

6. List every subset for $\sqrt{30}$.

Classify from a table.

7 Complete the table.

Number	-8	$0.\overline{6}$	π
Smallest type			

8 Complete the table.

Number	$\sqrt{16}$	$-\frac{9}{4}$	$\sqrt{2}+5$
Rational or irrational?			

9 Which number is whole but not natural?

A. -1 **B.** 0

C. $\sqrt{2}$ **D.** $\frac{1}{2}$

10 True or False: Every rational number is an integer.

☐ True ☐ False

Use real-number properties.

11 Name the property: $a + 0 = a$.

12 Name the property: $b \cdot \frac{1}{b} = 1$ for $b \neq 0$.

13 Expand $-3(4x - 5)$.

14 Simplify $6n + 4 - 9n + 8$.

Day 2 Laws of Exponents

SKILL SNAPSHOT

Exponent rules rewrite powers without changing their value. The rule you use depends on the operation and whether the bases match.

Operation	Rule	Example
Multiply same base	$a^m a^n = a^{m+n}$	$x^3 x^5 = x^8$
Divide same base	$\frac{a^m}{a^n} = a^{m-n}$	$\frac{y^7}{y^2} = y^5$
Power of a power	$(a^m)^n = a^{mn}$	$(z^4)^3 = z^{12}$
Negative exponent	$a^{-n} = \frac{1}{a^n}$	$5^{-2} = \frac{1}{25}$

- A zero exponent gives 1 when the base is not 0.
- An outside exponent applies to every factor inside parentheses.
- Coefficients use ordinary arithmetic; variables use exponent rules.
- Final answers are usually written with positive exponents.

Remember: Do not combine exponents unless the bases match. For example, x^3y^3 is not the same as $(xy)^6$.

Use product, quotient, and power rules.

1. Simplify $x^6 \cdot x^{-2}$. _____
2. Simplify $a^3 \cdot a^5 \cdot a^{-1}$. _____
3. Simplify $\frac{m^9}{m^4}$. _____
4. Simplify $\frac{p^2}{p^7}$ using positive exponents. _____
5. Simplify $(r^4)^3$. _____
6. Simplify $(2x^3)^2$. _____

Simplify expressions with several factors.

7. Simplify $(3a^2b)^2$. _____
8. Simplify $\frac{18m^7n^2}{6m^3n^5}$ using positive exponents. _____
9. Simplify $\frac{(4x^{-2})^2}{8x^{-5}}$. _____
10. Evaluate $7^0 + 2^{-3}$. _____
11. Evaluate $\left(\frac{2}{5}\right)^{-2}$. _____
12. True or False: $4^{-2} = -16$.

☐ True ☐ False

Interpret and correct exponent work.

13 A student writes $(5y^2)^3 = 5y^6$. Identify the error and correct it.

14 Use the table to write the final capacity as one power of 2, then evaluate.

Starting files	2^{11}
Number of doublings	4

Mixed Review

Week 1 Mixed Review

WEEKLY SKILL CHECK

This modified review emphasizes full real-number classification, algebraic exponent expressions, monomial radical denominators, and linear equations.

- Simplify first, then classify into every applicable number set.
- For exponent expressions, handle coefficients separately from variable powers.
- Rationalize only single-radical denominators on this review.
- Linear equations may have one solution, no solution, or infinitely many solutions.

Remember: Show enough work to make the algebra rule visible. That is what turns review into practice.

Real numbers and properties.

1. List every set for $\sqrt{36}$.

2. List every set for -4.5.

3. Which number is irrational?

   A. $\sqrt{64}$ **B.** $0.\overline{12}$

   C. $\sqrt{27}$ **D.** $-\frac{3}{5}$

4. Name the property:
   $4 + (x + 6) = (4 + x) + 6$.

Exponents and radicals.

5. Simplify $(3x^2)(-4x^5)$.

6. Simplify $\frac{16a^6b}{4a^2b^5}$.

7. Simplify $(2m^3n^2)^2$.

8. Simplify $\sqrt{108}$.

9. Simplify $2\sqrt{12} + 3\sqrt{27}$.

10. Rationalize $\frac{8}{\sqrt{2}}$.

Equations and checks.

11. Solve $3(x - 2) = 15$.

12. Solve $5x + 8 = 2x - 10$.

13. Classify $6(x + 1) = 6x + 6$.

14 Classify $2(x-4)=2x+3$. _____

Mixed table practice.

15 Complete the table.

Task	Classify $\pi - 1$	Simplify 5^{-2}	Solve $2x+9=21$
Answer	_____	_____	_____

16 A rectangle has perimeter 46 ft and length 14 ft. Find its width.

WEEK 3

Slope and Linear Graphs

A later sample to show graph and table practice.

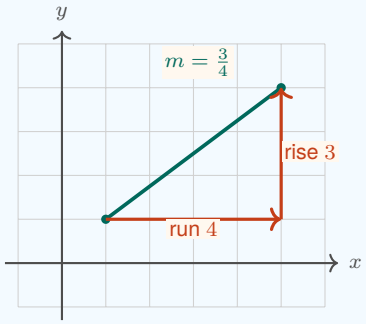
In This Week

Day 1	Rate of Change and Slope
Day 2	Writing Linear Equations
Day 3	Graphing Linear Functions
Day 4	Parallel and Perpendicular Lines
Mixed Review	Slope and Linear Graphs Mixed Review

Day 1 Rate of Change and Slope

SKILL SNAPSHOT

Slope is the rate of change of a line. It compares the change in y to the matching change in x: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$.



- Positive slopes rise from left to right, and negative slopes fall from left to right.
- A horizontal line has slope 0 because the rise is 0.
- A vertical line has undefined slope because the run is 0.
- In a table, slope is constant when equal changes in x give equal changes in y.
- In a situation, include units such as dollars per hour or feet per second.

Remember: Always match the top and bottom of the slope fraction: change in output over the same change in input.

Find slope from two points.

1. Find the slope through $(1, 4)$ and $(5, 12)$. _____

2. Find the slope through $(-2, 7)$ and $(4, -5)$. _____

3. Find the slope through $(3, -1)$ and $(3, 8)$. _____

4. Find the slope through $(-4, 2)$ and $(6, 2)$. _____

Use tables and graphs.

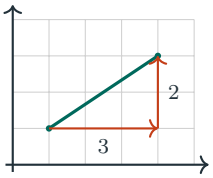
5. Use the table to find the rate of change. _____

x	0	2	4
y	5	9	13

6 Use the table to decide whether the relationship is linear. If it is, give the slope.

x	1	3	5
y	10	7	4

7 What slope is shown by the rise-run triangle?



8 A line falls 9 units while moving 3 units to the right. What is its slope? _____

Interpret slope in context.

9 A taxi fare increases from 18 dollars at 4 miles to 30 dollars at 8 miles. Find the slope and units.

10 A tank has 42 gallons after 2 minutes and 30 gallons after 6 minutes. Find the rate of change.

11 A line has slope $\frac{5}{2}$ and passes through $(2, 1)$. What is the y-value when $x = 4$?

12 True or False: A line with undefined slope is horizontal.

☐ True ☐ False

Choose and explain.

13 Which pair of points has slope -4?

A. $(0, 1)$ and $(2, 9)$
B. $(1, 7)$ and $(3, -1)$
C. $(-2, 5)$ and $(2, 7)$
D. $(4, -3)$ and $(4, 6)$

14 Which line has slope 0?

A. $x = 5$
B. $y = -2$
C. $y = 3x + 1$
D. $x + y = 6$

15 A table has points $(2, 9)$, $(5, 15)$, and $(8, 21)$. Is the slope constant? Explain.

ANSWER KEY

Answer Key & Explanations

Use the answers to check your work, then read the explanations to learn the method.

How to review

First compare your final answer. If it does not match, read the explanation slowly and redo the problem beside it. The goal is to understand the move that gets you from the question to the final answer.

Week 1 Day 1: The Real Number System and Properties

Answers

1. whole, integer, rational, real
2. integer, rational, real
3. natural, whole, integer, rational, real
4. natural, whole, integer, rational, real
5. rational, real
6. irrational, real
7. integer; rational; irrational
8. rational; rational; irrational
9. B
10. False
11. additive identity
12. multiplicative inverse
13. $-12x + 15$
14. $-3n + 12$

Explanations

1. 0 is included in the whole numbers and integers. Since every integer is rational and every rational is real, those sets also apply.
2. $-\sqrt{36} = -6$. A negative integer is not whole or natural, but it is rational and real.
3. $\sqrt{49} = 7$, and 7 is a counting number. The nested sets add whole, integer, rational, and real.
4. $\frac{14}{7} = 2$. After simplifying, 2 is natural and therefore belongs to every larger rational subset.
5. -3.25 is a terminating decimal, so it is rational. It is not an integer because it has a fractional part.
6. 30 is not a perfect square, so $\sqrt{30}$ cannot be written as a ratio of integers. It is still a real number.
7. -8 is an integer. A repeating decimal is rational, and π is irrational because its decimal never terminates or repeats.
8. $\sqrt{16} = 4$, and $-\frac{9}{4}$ is already a ratio of integers. Adding rational 5 to irrational $\sqrt{2}$ gives an irrational number.
9. 0 is a whole number but not a natural number in this classification. The other choices are not whole numbers.

10 *Every integer is rational, but the reverse is not true. For example, $\frac{1}{2}$ is rational but not an integer.*

11 *Adding 0 leaves a number unchanged. That makes 0 the identity for addition.*

12 *A nonzero number times its reciprocal equals 1. That reciprocal relationship is the multiplicative inverse property.*

13 *Distribute -3 to each term. The products are $-12x$ and $+15$.*

14 *Combine like terms by type. The variable terms give $6n - 9n = -3n$, and the constants give $4 + 8 = 12$.*

Week 1 Day 2: Laws of Exponents

Answers

1 x^4 2 a^7 3 m^5 4 $\frac{1}{p^5}$ 5 r^{12} 6 $4x^6$ 7 $9a^4b^2$ 8 $\frac{3m^4}{n^3}$

9 $2x$ 10 $\frac{9}{8}$ 11 $\frac{25}{4}$ 12 *False* 13 $125y^6$ 14 $2^{15} = 32{,}768$ *files*

Explanations

1 *When multiplying powers with the same base, add exponents. Since $6 + (-2) = 4$, the result is x^4.*

2 *Add the exponents because all factors have base a. The exponent is $3 + 5 - 1 = 7$.*

3 *Dividing powers with the same base means subtract exponents. The result is $m^{9-4} = m^5$.*

4 *Subtract exponents: $p^{2-7} = p^{-5}$. A negative exponent moves the power to the denominator, so the answer is $\frac{1}{p^5}$.*

5 *A power raised to a power uses multiplication of exponents. Since $4 \cdot 3 = 12$, the result is r^{12}.*

6 *The outside exponent applies to both the coefficient and the variable power. Square 2 to get 4 and multiply exponents on x to get x^6.*

7 *Square each factor inside the parentheses. This gives* $3^2 = 9$, $(a^2)^2 = a^4$, *and* b^2.

8 *Divide coefficients to get* 3. *Subtract exponents on matching bases:* $m^{7-3} = m^4$ *and* $n^{2-5} = n^{-3}$, *so* n^3 *goes in the denominator.*

9 *Square the numerator to get* $16x^{-4}$. *Then* $\frac{16x^{-4}}{8x^{-5}} = 2x^1 = 2x$.

10 $7^0 = 1$ *and* $2^{-3} = \frac{1}{8}$. *Adding gives* $1 + \frac{1}{8} = \frac{9}{8}$.

11 *A negative exponent takes the reciprocal first. Then* $\left(\frac{5}{2}\right)^2 = \frac{25}{4}$.

12 *A negative exponent does not make the answer negative. It means reciprocal, so* $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$.

13 *The outside exponent must also apply to the coefficient. The correct expression is* $5^3(y^2)^3 = 125y^6$.

14 *Four doublings multiply the starting amount by* 2^4. *Same-base multiplication adds exponents, so* $2^{11} \cdot 2^4 = 2^{15} = 32{,}768$.

Week 1: Mixed Review

Answers

1 *natural, whole, integer, rational, real*

2 *rational, real*

3 *C*

4 *associative property of addition*

5 $-12x^7$

6 $\frac{4a^4}{b^4}$

7 $4m^6n^4$

8 $6\sqrt{3}$

9 $13\sqrt{3}$

10 $4\sqrt{2}$

11 $x = 7$

12 $x = -6$

13 *infinitely many solutions*

14 *no solution*

15 *irrational;* $\frac{1}{25}$; $x = 6$

16 9 *ft*

Explanations

1 $\sqrt{36} = 6$, *a counting number. The nested sets then include whole, integer, rational, and real.*

2 -4.5 *is a terminating decimal, so it can be written as a fraction. It is not an integer because it has a fractional part.*

3 $\sqrt{27} = 3\sqrt{3}$, *and* $\sqrt{3}$ *is irrational. The other choices are rational.*

4 *The order of the addends stays the same, but the grouping changes. That is the associative property.*

5 *Multiply coefficients to get* -12. *Add exponents on the matching base* x, *giving* x^7.

6 *Divide coefficients and subtract exponents. The negative exponent on* b *moves it to the denominator.*

7 *Square each factor. The coefficient becomes* 4, *and both variable exponents double.*

8 *Factor out the largest perfect square:* $108 = 36 \cdot 3$. *The square root of* 36 *is* 6.

9 $\sqrt{12} = 2\sqrt{3}$ *and* $\sqrt{27} = 3\sqrt{3}$. *Then* $2(2\sqrt{3}) + 3(3\sqrt{3}) = 13\sqrt{3}$.

10 *Multiply by* $\frac{\sqrt{2}}{\sqrt{2}}$ *to get* $\frac{8\sqrt{2}}{2}$. *Reduce the coefficient to* $4\sqrt{2}$.

11 *Divide by* 3 *or distribute first:* $x - 2 = 5$. *Add* 2 *to get* $x = 7$.

12 *Subtract* $2x$ *to get* $3x + 8 = -10$. *Subtract* 8 *and divide by* 3, *giving* $x = -6$.

13 *Distributing gives* $6x + 6 = 6x + 6$, *which is always true. Every real number is a solution.*

14 *Distributing gives* $2x - 8 = 2x + 3$. *Subtracting* $2x$ *leaves a false statement, so no value works.*

15 *Subtracting a rational from irrational* π *stays irrational. A negative exponent gives a reciprocal, and solving* $2x + 9 = 21$ *gives* $2x = 12$, *so* $x = 6$.

16 *Use* $2\ell + 2w = 46$. *Substitute* $\ell = 14$ *to get* $28 + 2w = 46$, *so* $2w = 18$ *and* $w = 9$ *ft.*

Week 3 Day 1: Rate of Change and Slope

Answers

1. 2
2. -2
3. Undefined
4. 0
5. 2
6. Linear; $-\frac{3}{2}$
7. $\frac{2}{3}$
8. -3
9. 3 dollars per mile
10. -3 gallons per minute
11. 6
12. False
13. B
14. B
15. Yes; 2

Explanations

1. Use the slope formula: $\frac{12-4}{5-1} = \frac{8}{4} = 2$. The line rises 2 units for each 1 unit to the right.
2. Subtract the y-values and the matching x-values: $\frac{-5-7}{4-(-2)} = \frac{-12}{6} = -2$. A negative slope means the graph falls from left to right.
3. The x-values are the same, so the run is $3-3=0$. Division by 0 is undefined, so the vertical line has undefined slope.
4. The y-values are the same, so the rise is $2-2=0$. A horizontal line has slope 0 because 0 divided by a nonzero run is 0.
5. When x increases by 2, y increases by 4. The rate of change is $\frac{4}{2}=2$.
6. The x-values increase by 2 each step while the y-values decrease by 3. The constant rate is $\frac{-3}{2}$, so the relationship is linear.
7. The graph shows a rise of 2 and a run of 3. Slope is rise over run, so $m=\frac{2}{3}$.
8. Falling means the rise is negative, so the change in y is -9. The slope is $\frac{-9}{3}=-3$.
9. The cost changes by $30-18=12$ dollars while distance changes by $8-4=4$ miles. The slope is $\frac{12}{4}=3$ dollars per mile.
10. The amount changes by $30-42=-12$ gallons over $6-2=4$ minutes. The slope is $\frac{-12}{4}=-3$, meaning the tank loses 3 gallons each minute.
11. The input increases by 2, so multiply the slope by 2 to get a rise of 5. Starting from $y=1$, the new value is $1+5=6$.

12 *A horizontal line has slope 0 because the rise is 0. Undefined slope belongs to a vertical line because the run is 0.*

13 *For choice B, $\frac{-1-7}{3-1} = \frac{-8}{2} = -4$. The other choices give a different slope or an undefined slope.*

14 *The equation $y = -2$ keeps the y-value constant, so it is horizontal. Horizontal lines have slope 0.*

15 *From $(2, 9)$ to $(5, 15)$, the change is $\frac{6}{3} = 2$. From $(5, 15)$ to $(8, 21)$, the change is also $\frac{6}{3} = 2$, so the slope is constant.*

THANK YOU

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