

Grade 8 Math Diagnostic Test

Answer Key, Worked Solutions, and Score Interpretation

Student Name	_____
Date	_____
Teacher/Parent	_____

40 Questions	60-75 Minutes	No Calculator
------------------------	-------------------------	-------------------------

Common Core-aligned skill check for US middle-school mathematics

Matches the corrected Grade 8 student diagnostic test. Original assessment content. Not an official or endorsed Common Core assessment.

Scoring rule

- Award 1 point for each fully correct response.
- For multi-part questions, the full point requires all requested parts. Equivalent mathematically correct wording is acceptable.
- For explanation and graphing items, accept any response that clearly demonstrates the required Grade 8 reasoning.

Question	Answer	CCSS
1	C. 0.272727...	8.NS.1
2	C. 6.7	8.NS.2
3	C. $\sqrt{30} > 5.4$	8.NS.2
4	$\pi < \sqrt{10} < 3.2$	8.NS.2
5	B. $\frac{1}{4}$	8.EE.1
6	C. $x = \pm 7$	8.EE.2
7	-6	8.EE.2
8	B. 3.5×10^{-5}	8.EE.3
9	2.4×10^3	8.EE.4
10	B. 8.31×10^{-7}	8.EE.4
11	B. 2	8.EE.5
12	A. Function A	8.EE.5
13	Both give slope $\frac{2}{3}$.	8.EE.6
14	$x = 7$	8.EE.7
15	A. $3(x + 4) = 3x + 12$	8.EE.7
16	A. (2, 5)	8.EE.8
17	B. $\{(0, 2), (0, 5), (1, 8)\}$	8.F.1
18	a) Function A; b) Function B	8.F.2
19	C. Nonlinear because the rate of change is not constant.	8.F.3
20	$y = 3x + 1$	8.F.4

Quick Answer Key | Questions 21-40

Use the worked-solution pages for full-credit criteria on constructed-response items.

Question	Answer	CCSS
21	Increasing; constant; decreasing	8.F.5
22	Join (0,1) → (3,5) → (5,5) → (8,2) with straight segments.	8.F.5
23	a) Function B; b) Function A	8.F.2
24	$C(m) = 7m + 15$	8.F.4
25	D. Clockwise/counterclockwise orientation	8.G.1
26	A. Rotate 90° counterclockwise, then translate 5 right and 1 up.	8.G.2
27	3	8.G.3
28	B. Similar with scale factor 1.5	8.G.4
29	C. 118°	8.G.5
30	$a^2 + b^2 = c^2$	8.G.6
31	15 units	8.G.7
32	13 units	8.G.7
33	10 units	8.G.8
34	a) 108π cubic units; b) 36π cubic units; c) 36π cubic units	8.G.9
35	B. Positive association with one noticeable outlier	8.SP.1
36	Approximately (7, 5)	8.SP.1
37	A. $y = 1.5x + 2$	8.SP.2
38	Slope: 1.5 cm/week; intercept: 12 cm	8.SP.3
39	Bus: 60%; Walk/Bike: 75%	8.SP.4
40	Yes; 75% vs 60% suggests an association.	8.SP.4

1 Which number is rational?

Answer: C. 0.272727...

Worked method: A repeating decimal is rational because it can be written as a fraction. Here, $0.272727... = 27/99 = 3/11$. The other listed values are irrational.

Standard: 8.NS.1

2 Which value is closest to $\sqrt{45}$, rounded to the nearest tenth?

Answer: C. 6.7

Worked method: Since $6^2 = 36$ and $7^2 = 49$, $\sqrt{45}$ is between 6 and 7. $\sqrt{45}$ is approximately 6.708, which rounds to 6.7.

Standard: 8.NS.2

3 Which statement correctly compares $\sqrt{30}$ and 5.4?

Answer: C. $\sqrt{30} > 5.4$

Worked method: $5.4^2 = 29.16$, which is less than 30. Therefore $\sqrt{30}$ must be greater than 5.4. Numerically, $\sqrt{30}$ is about 5.477.

Standard: 8.NS.2

4 Order π , $\sqrt{10}$, and 3.2 from least to greatest.

Answer: $\pi < \sqrt{10} < 3.2$

Worked method: Use decimal approximations: π is about 3.142 and $\sqrt{10}$ is about 3.162. Therefore $3.142 < 3.162 < 3.2$.

Standard: 8.NS.2

5 Simplify $2^3 \times 2^{-5}$.

Answer: B. $1/4$

Worked method: For powers with the same base, combine the exponents: $2^3 \times 2^{-5} = 2^{-2} = 1/2^2 = 1/4$.

Standard: 8.EE.1

6 Solve $x^2 = 49$.

Answer: C. $x = \pm 7$

Worked method: Both 7^2 and $(-7)^2$ equal 49, so the equation has two solutions: $x = 7$ and $x = -7$.

Standard: 8.EE.2

7 Evaluate $\sqrt[3]{-216}$.

Answer: -6

Worked method: Because $(-6)^3 = -216$, $\sqrt[3]{-216} = -6$.

Standard: 8.EE.2

8 Compare 7.2×10^{-6} and 3.5×10^{-5} .

Answer: B. 3.5×10^{-5}

Worked method: Write both with the same power of 10: $7.2 \times 10^{-6} = 0.72 \times 10^{-5}$. Since $3.5 > 0.72$, 3.5×10^{-5} is greater.

Standard: 8.EE.3

9 Compute $(6 \times 10^5)(4 \times 10^{-3})$ in scientific notation.

Answer: 2.4×10^3

Worked method: Multiply the coefficients: $6 \times 4 = 24$. Combine powers: $10^5 \times 10^{-3} = 10^2$. Thus $24 \times 10^2 = 2.4 \times 10^3$.

Standard: 8.EE.4

10 Interpret the calculator display 8.31E-7.

Answer: B. 8.31×10^{-7}

Worked method: Calculator E notation means “times 10 to the power.” Therefore $8.31\text{E}-7 = 8.31 \times 10^{-7}$.

Standard: 8.EE.4

11 Find the unit rate, or slope, of the proportional graph.

Answer: B. 2

Worked method: Use two points on the line, such as (0, 0) and (4, 8). Slope = rise/run = $(8 - 0)/(4 - 0) = 8/4 = 2$.

Standard: 8.EE.5

12 Compare the rates of change of Function A and Function B.

Answer: A. Function A

Worked method: Function A: $(6 - 0)/(2 - 0) = 3$. Function B: $(4 - 0)/(2 - 0) = 2$. Because $3 > 2$, Function A has the greater rate of change.

Standard: 8.EE.5

13 Explain what rise/run ratios $\frac{2}{3}$ and $\frac{4}{6}$ show about the slope of one line.

Answer: Both give slope $\frac{2}{3}$.

Worked method: The ratios are equivalent: $\frac{4}{6}$ simplifies to $\frac{2}{3}$. Right triangles drawn along the same straight line have the same rise/run ratio, so the slope is constant and equals $\frac{2}{3}$.

Standard: 8.EE.6

14 Solve $4(2x - 3) = 5x + 9$.

Answer: $x = 7$

Worked method: Distribute: $8x - 12 = 5x + 9$. Subtract $5x$: $3x - 12 = 9$. Add 12: $3x = 21$. Divide by 3: $x = 7$.

Standard: 8.EE.7

15 Which equation has infinitely many solutions?

Answer: A. $3(x + 4) = 3x + 12$

Worked method: Distribute the left side: $3x + 12 = 3x + 12$. Both sides are identical for every value of x , so there are infinitely many solutions.

Standard: 8.EE.7

16 Solve $y = 2x + 1$ and $y = -x + 7$.

Answer: A. (2, 5)

Worked method: Set the two expressions for y equal: $2x + 1 = -x + 7$. Then $3x = 6$, so $x = 2$. Substitute: $y = 2(2) + 1 = 5$.

Standard: 8.EE.8

17 Which relation is NOT a function?

Answer: B. $\{(0, 2), (0, 5), (1, 8)\}$

Worked method: A function assigns exactly one output to each input. In choice B, the input 0 is paired with both 2 and 5, so the relation is not a function.

Standard: 8.F.1

18 Compare Function A and Function B.

Answer: a) Function A; b) Function B

Worked method: Function A has slope $(11 - 5)/(2 - 0) = 3$ and initial value 5. Function B is $y = 2x + 9$, so its slope is 2 and its initial value is 9. Therefore A has the greater rate of change, while B has the greater initial value.

Standard: 8.F.2

19 Classify the relationship $x = 0,1,2,3$; $y = 1,4,9,16$.

Answer: C. Nonlinear because the rate of change is not constant.

Worked method: The first differences in y are 3, 5, and 7. Because these changes are not constant for equal changes in x , the relationship is nonlinear.

Standard: 8.F.3

20 Write the linear equation for $x = 1,3,5,7$ and $y = 4,10,16,22$.

Answer: $y = 3x + 1$

Worked method: Slope = $(10 - 4)/(3 - 1) = 6/2 = 3$. Use $(1, 4)$: $4 = 3(1) + b$, so $b = 1$. Therefore $y = 3x + 1$.

Standard: 8.F.4

21 Describe the graph on $x = 0$ to 4, $x = 4$ to 6, and $x = 6$ to 8.

Answer: Increasing; constant; decreasing

Worked method: From $x = 0$ to 4, y rises from 2 to 6, so the function increases. From $x = 4$ to 6, y stays at 6, so it is constant. From $x = 6$ to 8, y falls from 6 to 3, so it decreases.

Standard: 8.F.5

22 Sketch the graph described by the four key points.

Answer: Join $(0,1) \rightarrow (3,5) \rightarrow (5,5) \rightarrow (8,2)$ with straight segments.

Worked method: A correct graph begins at $(0, 1)$, rises steadily to $(3, 5)$, is horizontal from $(3, 5)$ to $(5, 5)$, then falls steadily to $(8, 2)$. Equivalent accurately drawn sketches earn full credit.

Standard: 8.F.5

23 Compare Function A in the graph with Function B, which has initial value 1 and rate of change 2.

Answer: a) Function B; b) Function A

Worked method: Function A passes through approximately $(0, 4)$, $(4, 6)$, and $(8, 8)$, giving slope $(8 - 4)/(8 - 0) = 1/2$ and initial value 4. Function B has slope 2 and initial value 1. Thus B has the greater rate of change, while A has the greater initial value.

Standard: 8.F.2

24 Model a service with a \$15 setup fee plus \$7 per month.

Answer: $C(m) = 7m + 15$

Worked method: The fixed setup fee is the initial value, 15. The cost increases by \$7 for each month, so 7 is the rate of change. Therefore $C(m) = 7m + 15$.

Standard: 8.F.4

25 A figure is reflected across a line. Which property may change?

Answer: D. Clockwise/counterclockwise orientation

Worked method: A reflection preserves lengths, angle measures, and parallel relationships, but it reverses orientation. A clockwise ordering of vertices becomes counterclockwise, or vice versa.

Standard: 8.G.1

26 Identify the transformation sequence mapping triangle ABC to A'B'C'.

Answer: A. Rotate 90° counterclockwise, then translate 5 right and 1 up.

Worked method: For example, A(1,1) rotates 90° counterclockwise to (-1,1), then translating by (5,1) gives (4,2) = A'. The same rule sends B(3,1) to B'(4,4) and C(1,3) to C'(2,2).

Standard: 8.G.2

27 A dilation maps (2, -1) to (6, -3). Find the scale factor.

Answer: 3

Worked method: For a dilation centered at the origin, multiply each coordinate by the same scale factor k . Since $2k = 6$, $k = 3$; also $(-1)(3) = -3$.

Standard: 8.G.3

28 Compare triangles with side lengths 4,6,8 and 6,9,12.

Answer: B. Similar with scale factor 1.5

Worked method: Compare corresponding sides: $6/4 = 9/6 = 12/8 = 1.5$. One triangle is a dilation of the other by a constant factor of 1.5, so the triangles are similar, not congruent.

Standard: 8.G.4

29 Lines l and m are parallel. Find x .

Answer: C. 118°

Worked method: The 118° angle and x are alternate interior angles formed by a transversal crossing parallel lines. Alternate interior angles are congruent, so $x = 118^\circ$.

Standard: 8.G.5

30 Simplify $(a + b)^2 = 4(\frac{1}{2}ab) + c^2$ to obtain the Pythagorean Theorem.

Answer: $a^2 + b^2 = c^2$

Worked method: Expand the left side: $a^2 + 2ab + b^2$. The right side is $2ab + c^2$. Subtract $2ab$ from both sides to get $a^2 + b^2 = c^2$. For a right triangle, the sum of the squares of the leg lengths equals the square of the hypotenuse.

Standard: 8.G.6

31 A right triangle has legs 9 and 12. Find the hypotenuse.

Answer: 15 units

Worked method: Use $a^2 + b^2 = c^2$: $9^2 + 12^2 = c^2$. Then $81 + 144 = 225$, so $c = \sqrt{225} = 15$.

Standard: 8.G.7

32 Find the space diagonal of a 3 by 4 by 12 rectangular box using two Pythagorean steps.

Answer: 13 units

Worked method: First find the 3-by-4 face diagonal: $d^2 = 3^2 + 4^2 = 25$, so $d = 5$. Then use that 5-unit diagonal with the 12-unit height: $D^2 = 5^2 + 12^2 = 25 + 144 = 169$, so $D = 13$.

Standard: 8.G.7

33 Find the distance between (-2, 3) and (4, -5).

Answer: 10 units

Worked method: Horizontal change = $4 - (-2) = 6$. Vertical change = $-5 - 3 = -8$. Distance = $\sqrt{(6^2 + (-8)^2)} = \sqrt{(36 + 64)} = \sqrt{100} = 10$.

Standard: 8.G.8

34 Find the volumes of a cylinder, cone, and sphere with the given dimensions.

Answer: a) 108π cubic units; b) 36π cubic units; c) 36π cubic units

Worked method: Cylinder: $V = \pi r^2 h = \pi(3^2)(12) = 108\pi$. Cone: $V = (1/3)\pi r^2 h = (1/3)(108\pi) = 36\pi$. Sphere: $V = (4/3)\pi r^3 = (4/3)\pi(27) = 36\pi$.

Standard: 8.G.9

35 Describe the overall scatter-plot pattern.

Answer: B. Positive association with one noticeable outlier

Worked method: Most points rise as x increases, indicating a positive association. One point near $(7, 5)$ lies far below the main upward pattern, making it a noticeable outlier.

Standard: 8.SP.1

36 Identify the outlier in the scatter plot.

Answer: Approximately $(7, 5)$

Worked method: The point near $x = 7$ and $y = 5$ is separated well below the main increasing cluster, so it is the outlier.

Standard: 8.SP.1

37 Choose the most reasonable linear model for the scatter plot.

Answer: A. $y = 1.5x + 2$

Worked method: The plotted values begin near $y = 2$ when $x = 0$ and rise by about 1.5 units in y for each 1-unit increase in x . The equation $y = 1.5x + 2$ matches both the intercept and the positive slope.

Standard: 8.SP.2

38 Interpret $h = 1.5w + 12$ for plant height.

Answer: Slope: 1.5 cm/week; intercept: 12 cm

Worked method: The slope 1.5 means the model predicts plant height increases by about 1.5 centimeters for each additional week. The intercept 12 means the model predicts a height of 12 centimeters when $w = 0$ weeks.

Standard: 8.SP.3

39 Find sports-participation relative frequencies within each transportation group.

Answer: Bus: 60%; Walk/Bike: 75%

Worked method: Bus: 18 of 30 participate, so $18/30 = 0.60 = 60\%$. Walk/Bike: 30 of 40 participate, so $30/40 = 0.75 = 75\%$.

Standard: 8.SP.4

40 Does the table suggest an association between transportation mode and sports participation?

Answer: Yes; 75% vs 60% suggests an association.

Worked method: Sports participation is 75% among Walk/Bike students and 60% among Bus students, a 15-percentage-point difference. That difference suggests an association in this sample. It does not show that transportation mode causes sports participation.

Standard: 8.SP.4

Score Interpretation | Complete after checking the answer key

Record the score for each domain. Use the result to decide what to review next.

Domain	Questions	Score	Maximum	Review Priority
The Number System	1-4	___ / 4	4	High / Medium / Low
Expressions and Equations	5-16	___ / 12	12	High / Medium / Low
Functions	17-24	___ / 8	8	High / Medium / Low
Geometry	25-34	___ / 10	10	High / Medium / Low
Statistics and Probability	35-40	___ / 6	6	High / Medium / Low

Overall score guide

- 34-40: Strong readiness - begin Grade 8 practice papers and challenge work.
- 26-33: Generally on track - review the domains with the lowest scores.
- 18-25: Developing - complete targeted lessons before a full practice paper.
- 0-17: Foundation support recommended - revisit prerequisite skills step by step.

Constructed-response full-credit notes

- Q18 and Q23: both comparison parts must be correct.
- Q22: the graph must pass through (0,1), (3,5), (5,5), and (8,2), with the stated increasing/constant/decreasing segments.
- Q24: include the function and interpret both 15 and 7.
- Q30 and Q32: show a valid mathematical derivation or equivalent reasoning.
- Q34 and Q39: all requested subparts must be correct.
- Q38: interpret both slope and intercept in context.
- Q40: identify the association using 75% versus 60% and avoid a causal claim.

Diagnostic note: This test samples important Grade 8 skills. It is not a standardized test and should be considered alongside classroom work, teacher feedback, and student confidence.