

Key Features of Graphs and Rates of Change

Grade 9 – Algebra 1 math · Test Answer Key · Standards: F-IF.B.4, F-IF.B.6, F-IF.C.9

Use this answer key to score the test. Accept intervals written with inequalities or interval notation, and award credit for correct reasoning even if the final arithmetic has one small slip.

Standards: F-IF.B.4, F-IF.B.6, F-IF.C.9 · **Level:** Grade 9 Algebra 1

Question 1 Intercepts from an equation (2 points)

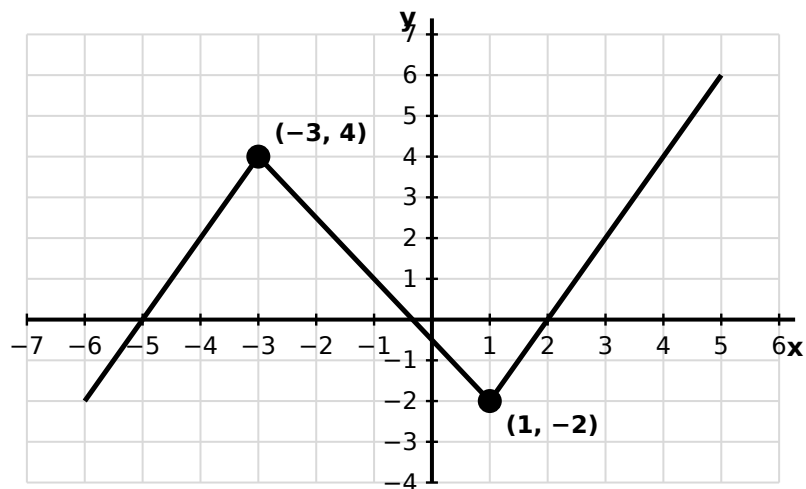
$y = 0$: $3x = 30$ so $x = 10$. $x = 0$: $-5y = 30$ so $y = -6$.

(10, 0) and (0, -6)

Scoring: 1 point per intercept.

Question 2 Features of a graph (3 points)

- (a) Increasing for $-6 < x < -3$ and $1 < x < 5$.
 (b) Decreasing for $-3 < x < 1$.
 (c) Relative maximum $(-3, 4)$, relative minimum $(1, -2)$.



Relative maximum and minimum.

Scoring: 1 point per part.

Question 3 Rate of change from a table (3 points)

(a) $(77 - 11) \div (9 - 3) = 66 \div 6 = 11$.

(b) On average, $f(x)$ increases by 11 for each 1-unit increase in x between 3 and 9 (it is not constant: the rate between 0 and 3 is only 2).

11

Scoring: (a) 1 point for the setup, 1 for 11; (b) 1 point.

Question 4 Zeros and end behavior (2 points)

(a) $-x^2 + 9 = 0$ gives $x^2 = 9$, so $x = 3$ or $x = -3$.

(b) The parabola opens down, so $f(x) \rightarrow -\infty$ as $x \rightarrow \infty$ and as $x \rightarrow -\infty$.

Zeros ± 3 ; falls at both ends

Scoring: 1 point per part.

Question 5 Drone flight (3 points)

(a) $(100 - 20) \div 4 = 20$ ft/s.

(b) $(40 - 100) \div 6 = -10$ ft/s.

(c) The negative sign means the drone is descending on average between 4 and 10 seconds.

20 ft/s and -10 ft/s

Scoring: 1 point per part.

Question 6 Axis of symmetry (2 points)

(a) The vertex is at $x = -2$, so the line is $x = -2$.

(b) $(1, 4)$ is 3 right of the line, so the mirror point is 3 left: $(-5, 4)$. Check: $f(-5) = 9 - 5 = 4$.

$x = -2$; $(-5, 4)$

Scoring: 1 point per part.

Question 7 Compare two functions (2 points)

f has rate 6 and g increases by 7 each step, so g has the greater rate.

$f(0) = -4$ and $g(0) = 2$, so g also has the greater y -intercept.

g in both cases

Scoring: 1 point for each comparison.

Question 8 Parabola features (3 points)

(a) The vertex is $(2, -4)$, a minimum.

(b) The graph crosses the x -axis at 0 and 4.

(c) The graph is below the x -axis for $0 < x < 4$.

$(2, -4)$ minimum; 0 and 4; negative for $0 < x < 4$

Scoring: 1 point per part.