

/K	/A	/C	/T	Total	/
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Name: Answers

Date: _____

MCR3U

Test: Quadratic functions

/9
K

1. Graph each of the following functions. Graphs should include all points that appear in the domain and range of the grid provided, with a smooth line passing through the points.

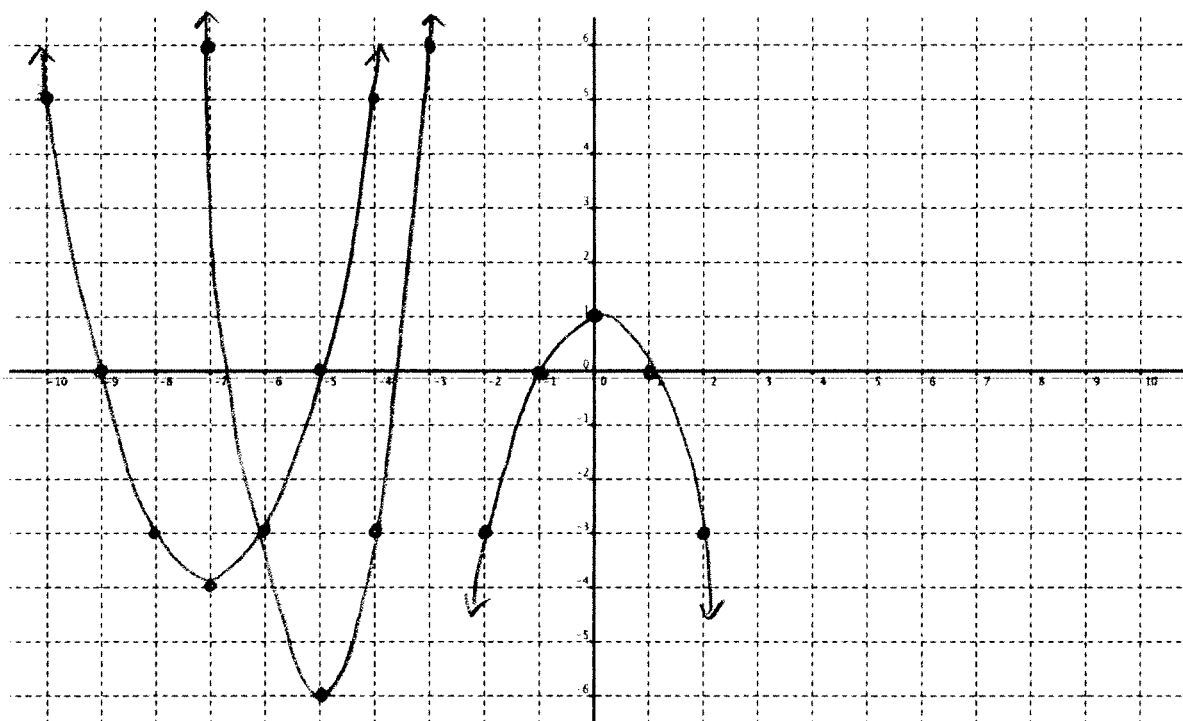
a) $g(x) = (x+7)^2 - 4$

b) $r(x) = 1 - x^2$
 $= -x^2 + 1$

c) $h(x) = 3x^2 + 30x + 69$

$x = \frac{-b}{2a} = \frac{-30}{2(3)} = -5$

$h(-5)$
 $= 3(-5)^2 + 30(-5) + 69$
 $= 75 - 150 + 69$
 $= -6$
 $V(-5, -6)$



/4
T

2. An energy company x thousands of barrels of synfuel from coal, and estimates that the production cost, c , in dollars per barrel of synfuel can be modeled by the function $c(x) = 9x^2 - 144x + 940$. Determine the minimum production cost per barrel of synfuel.

↓
Vertex

$x = \frac{-b}{2a} = \frac{-(-144)}{2(9)} = 8$

$c(8) = 9(8)^2 - 144(8) + 940$
 $= 576 - 1152 + 940$
 $= 304 + 364$

∴ Min cost is ~~304~~ 364 / barrel

/2
T/4
A

3. A banquet hall advertises that they will host a party for \$50 per person on New Year's Eve. They must have a guarantee of 30 people, but they agree that for each person in excess of 30 they will reduce the price per person for everyone by \$0.50. Determine the number of people that will maximise the hall's revenue. $x = \# \text{ people in excess of } 30$

$$R = (30 + x)(50 - 0.50x) \quad \checkmark \checkmark 2A$$

$$= 1500 + 50x - 15x - 0.5x^2$$

$$= -0.5x^2 + 35x + 1500 \quad \checkmark A$$

$$= -0.5(x^2 - 70x + 3000)$$

$$\text{Vertex: } x = \frac{-b}{2a} = \frac{70}{2(-1)} = 35 \quad \checkmark A \quad \checkmark A$$

$\therefore 65$ people (35 more than the minimum of 30) will maximize revenue, $\checkmark A$

/3
A

4. Some math students are firing a potato launcher from the deck of their cottage and analysing the flight of each potato. They have modelled the height of a potato above the water, h metres, using the function $h(t) = -4.9t^2 + 15t + 30$, where t is the time in seconds after the potato is launched. Determine how long each potato is in the air.

↑ ↑
x-intercept +

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$\checkmark A$

$$= \frac{-15 \pm \sqrt{(-15)^2 - 4(-4.9)(30)}}{2(-4.9)}$$

$$= \frac{-15 \pm \sqrt{225 + 588}}{-9.8}$$

$$= 4.43 \text{ or } -1.38$$

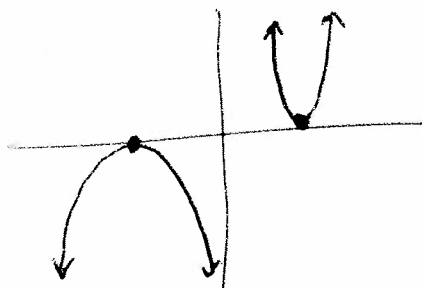
} $\checkmark A$

\therefore It was in air for 4.43s $\checkmark A$

1/2
C

5. If a certain quadratic function has only one x-intercept, what does this tell us about its vertex. Sketch an example to justify your answer.

It is the vertex



1/6
K

6. Solve each of the following quadratic equations.

a) $3x^2 - 5x + 6 = 0$

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{5 \pm \sqrt{(-5)^2 - 4(3)(6)}}{2(3)} \\ &= \frac{5 \pm \sqrt{25 - 72}}{6} \\ &= \frac{5 \pm \sqrt{-47}}{6} \end{aligned}$$

No Solutions

b) $12x^2 - 27 = 0$

$$0 = 3(4x^2 - 9)$$

$$4x^2 - 9 = 0$$

$$(2x - 3)(2x + 3) = 0$$

$$x = \frac{3}{2} \pm \frac{3}{2}$$

$\frac{1}{4}$
T

7. Determine an equation in factored form for the quadratic function that contains the point (0, 8) and has x-intercepts at 4 and -3.

$$y = a(x-4)(x+3) \quad \checkmark$$

$$8 = a(0-4)(0+3) \quad \checkmark$$

$$8 = a(-4)(3)$$

$$8 = -12a$$

$$a = \frac{8}{-12} = -\frac{2}{3} \quad \checkmark$$

$$\therefore y = -\frac{2}{3}(x-4)(x+3) \quad \checkmark$$

$\frac{1}{2}$
C

8. State the transformations for the function $g(x) = -(x-9)^2$ from the base graph $f(x) = x^2$.

$\frac{1}{2}$
C

9. Describe how the graph of $g(x) = (3x)^2$ is different from the graph of $h(x) = 3x^2$.

10. Determine the point(s) of intersection of the functions $f(x) = 2(x-6)^2 - 1$ and $g(x) = 8x - 57$.

$$= 2(x^2 - 12x + 36) - 1$$

$$= 2x^2 - 24x + 72 - 1$$

$$= 2x^2 - 24x + 71$$

$$2x^2 - 24x + 71 = 8x - 57 \quad \checkmark$$

$$2x^2 - 24x - 8x + 71 + 57 = 0$$

$$2x^2 - 32x + 128 = 0$$

$$2(x^2 - 16x + 64) = 0$$

$$2(x-8)(x-8) = 0$$

$$x = 8$$

$$\begin{aligned} \text{so } y &= 8(8) - 57 \\ &= 64 - 57 \\ &= 7 \end{aligned} \quad \checkmark$$

\therefore They intersect at $(8, 7)$ \checkmark

1/2
K

11. Write an equation for the quadratic function formed when the following transformations are applied to the base graph $f(x) = x^2$:

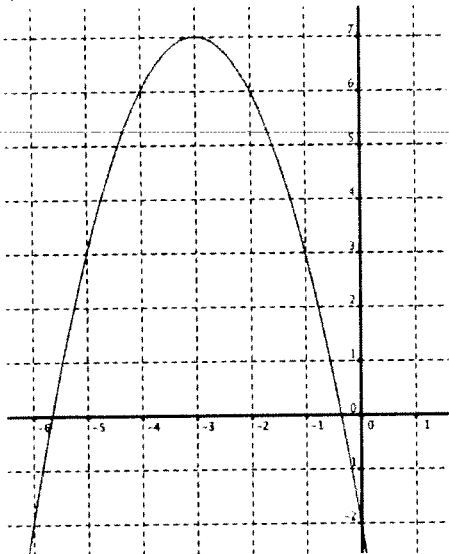
- stretched vertically by a factor of 4
- translated vertically 3 units down

$$y = 4x^2 - 3$$

1/2
C

12. A student wrote the following equations for the graphs provided below. State the error in each of the equations (why do they NOT correctly represent the graphs?).

$$f(x) = -(x+3) + 7$$



$$g(x) = (x+1)(x+5)$$

