

KNOWLEDGE (KU)		1/26
APPLICATION (AP)		1/13
THINKING (TI)		1/12
COMMUNICATION (CO)		level

Name: _____

ANSWERS

Test #5 Applying Quadratic Models

Knowledge & Understanding (KU)

1. Describe the transformations you would apply to the graph of $y = x^2$, to obtain the graph of the quadratic relation listed below. Once you have described the relation, then identify the **direction of opening**, the coordinates of the **vertex**, and the equation of the **axis of symmetry**. Sketch the graph of the quadratic relation by hand. (Note: list a, h & k first)

$y = 2(x + 3)^2 - 5$

A.O.S.

$a = 2$ vertical stretch by a factor of 2 ✓

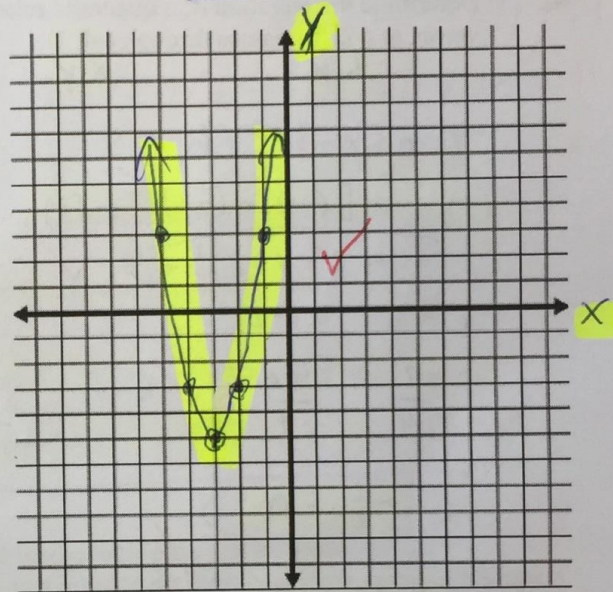
$h = -3$ horizontal shift left 3 units ✓

$k = -5$ vertical shift down 5 units ✓

direction of opening opens up ✓

vertex $(-3, -5)$ ✓

A.O.S. $x = -3$ ✓



Step pattern

1, 3, 5, ... etc
1(2), 3(2), 5(2), ... etc

2, 6, 10, ... etc

Out of 10

2. Write the equation of a parabola that matches the description. The graph of $y = x^2$ is reflected about the x-axis, compressed vertically by a factor of 0.75, translated 8 units left, and translated 4 units down. (Note: list a, h & k first)

$a = -0.75$ ✓

$h = -8$ ✓

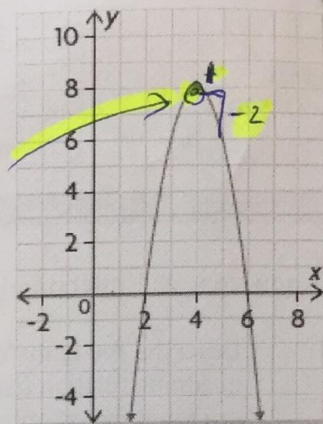
$k = -4$ ✓

$y = -0.75(x + 8)^2 - 4$ ✓

Out of 4

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3. Determine the equation in vertex form for the following graph on the right.
(Note: list a, h & k first)



$$a = -2 \checkmark$$

$$h = 4 \checkmark$$

$$k = 8 \checkmark$$

Out of 4

h k
(4, 8)

$$y = -2(x-4)^2 + 8 \checkmark$$

4. Determine the equation of a quadratic relation in vertex form, given the following information.
vertex at (-2, 3), passes through (-4, 1).

h k

x y

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

$$(1) = a[(-4) - (-2)]^2 + (3)$$

$$1 = a(-4+2)^2 + 3 \checkmark$$

$$1 - 3 = a(-2)^2$$

$$\frac{-2}{4} = \frac{4a}{4} \checkmark$$

$$a = -\frac{1}{2}$$

$$h = -2$$

$$k = 3$$

Out of 4

$$y = -\frac{1}{2}(x+2)^2 + 3 \checkmark$$

$$\frac{-1}{2} = a$$

or

$$-0.5 = a$$

6. Determine the vertex of $y = 8x^2 - 96x + 15$ by completing the square.

$$y = \left(\frac{8x^2 - 96x}{8}\right) + 15$$

$$y = 8(x^2 - 12x) + 15$$

$$y = 8(x^2 - 12x + 36 \rightarrow 36) + 15$$

$$y = 8(x^2 - 12x + 36) + 15 - 288 \checkmark$$

$$y = 8(x-6)^2 - 273 \checkmark$$

vertex (6, -273) \checkmark

$$c = \left(\frac{b}{2}\right)^2$$

$$c = \left(\frac{-12}{2}\right)^2 \checkmark$$

$$c = (-6)^2 \checkmark$$

$$c = 36$$

Out of 4

Application (AP)

1. The height, h , of a football in metres t seconds since it was kicked can be modelled by
 $h = -4.9t^2 + 22.54t + 1.1$

- a.) What was the height of the football when the punter kicked it?
b.) Determine the maximum height of the football, correct to one decimal place, and the time when it reached this maximum height.

a.) $t = 0$

$$h = -4.9(0)^2 + 22.54(0) + 1.1$$

$$h = 1.1 \text{ m}$$

\therefore the football was punted at 1.1 m high

Out of 8

b.) $h = -\frac{4.9}{-4.9}t^2 + \frac{22.54}{-4.9}t + 1.1$

$$c = \left(\frac{b}{2}\right)^2 \quad h = -4.9(t^2 - 4.6t) + 1.1$$

$$c = \left(\frac{-4.6}{2}\right)^2 \quad h = -4.9(t^2 - 4.6t + 5.29 - 5.29) + 1.1$$

$$c = (-2.3)^2 \quad h = -4.9(t - 2.3)^2 + 1.1 + 25.9$$

$$c = 5.29 \quad h = -4.9(t - 2.3)^2 + 27$$

$$\therefore \text{vertex } \begin{matrix} t & h \\ (2.3, & 27) \end{matrix}$$

\therefore the max height is 27m and this happens at 2.3s

2. The cost, C , in dollars, to hire landscapers to weed and seed a local park can be modelled by $C = 6x^2 - 60x + 900$, where x is the number of landscapers hired to do the work. How many landscapers should be hired to minimize the cost?

$$c = \left(\frac{b}{2}\right)^2$$

$$c = \left(\frac{-10}{2}\right)^2$$

$$c = (-5)^2$$

$$c = 25$$

$$C = \left(\frac{6x^2 - 60x}{6}\right) + 900$$

$$C = 6(x^2 - 10x) + 900$$

$$C = 6(x^2 - 10x + 25 - 25) + 900$$

$$C = 6(x - 5)^2 + 900 - 150$$

$$C = 6(x - 5)^2 + 750$$

Out of 5

$$\text{vertex } \begin{matrix} x & C \\ (5, & 750) \end{matrix}$$

\therefore 5 landscapers should minimize the cost.

Thinking & Inquiry (TI)

1. When a graph of $y = x^2$ is transformed, the point (2, 4) moves to (6, 19). Create two sets of transformations that could make this happen. For each set, give the equation of the new parabola.

① $(2+4, 4+15) \rightarrow (6, 19)$

$a=1$ $h=4$ $k=15$

$\therefore y = (x-4)^2 + 15$

② $(2+4, 4 \times 4 + 3) \rightarrow (6, 19)$

$a=4$ $h=4$ $k=3$

$\therefore y = 4(x-4)^2 + 3$

Out of 6

2. Determine the values of a and b in the relation $y = ax^2 + bx + 8$ if the vertex is located at (1, 7).

y -int $(0, 8)$ vertex $(1, 7)$
 x y h k

$y = ax^2 + bx + 8$

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

$(7) = (1)(1)^2 + b(1) + 8$

$(8) = a[(0)-(1)]^2 + 7$

$7 = 1 + b + 8$

$8 = a(-1)^2 + 7$

$7 - 1 - 8 = b$

$8 - 7 = a$

$-2 = b$

$1 = a$

Out of 4

3. Abigail claims that changing the value of a in quadratic relations of the form $y = ax^2$ will never result in a parabola that is congruent to the parabola $y = 2x^2$. Do you agree or disagree? Justify your decision.

I disagree with Abigail. If $a=2$ or $a=-2$ then $y=2x^2$ or $y=-2x^2$ is congruent to $y=2x^2$

Out of 2

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