MBF3C Name: _____ Date: _____

Unit Test
Quadratics I – Vertex Form

Know	App	Think
18	14	8

Communication	Level 1	Level 2	Level 3	Level 4
Correct use of mathematical symbols, labels, and conventions including units of measure, therefore statements, formulas, labels, clarity of solution, show all work.	Few mathematical conventions are used correctly.	Some mathematical conventions are used correctly.	Most mathematical conventions are used correctly.	Mathematical conventions are used correctly.

KNOWLEDGE & UNDERSTANDING

1. Use the following equation to answer questions I to V. **Circle** the correct answer. ❺

$$y = 3(x-4)^2 - 8$$

Vertex (h, k)

I. What is the vertex?
a) (4, -8) b) (-4, -8) c) (-4, 8) d) (4, 8)

II. What is the axis of symmetry?
a) x = 8 b) x= 4 c) x= -8 d) x = -4

III. What is the optimal value?
a) y = 8 b) y = 4 c) y = -8 d) y = -4

IV. What is the step pattern?
a) 1, 3, 9 b) 3, 6, 9 c) 4, 12, 20 d) 3, 9, 15

V. In which direction does the parabola open?
a) up b) down c) left d) right

since $a = +3$ it opens up

2. Looking at the parabola on the right, answer the following questions in the space provided. ❺

a) What is the vertex?

(5, 4)

b) What are the coordinates of the zeros (x-intercepts)?

A (3.5, 0) B (6.5, 0)

c) Does the graph have a maximum or a minimum?

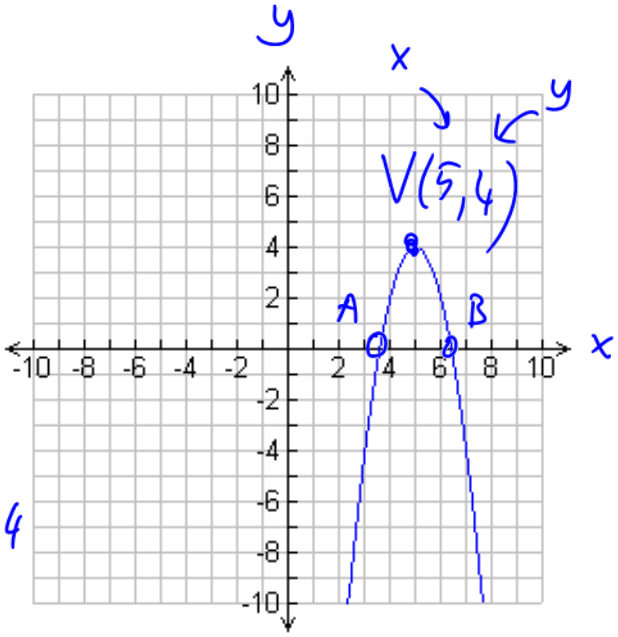
max

d) What is the optimal value?

y-coordinate of the vertex
if vertex (5, 4), then opt. val is 4

e) What is the axis of symmetry?

x-coordinate of the vertex
it's $x = 5$



Follow BEDMAS $(-)^2 = +$ $-^2 = -$

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3. Complete the following table below. ❸

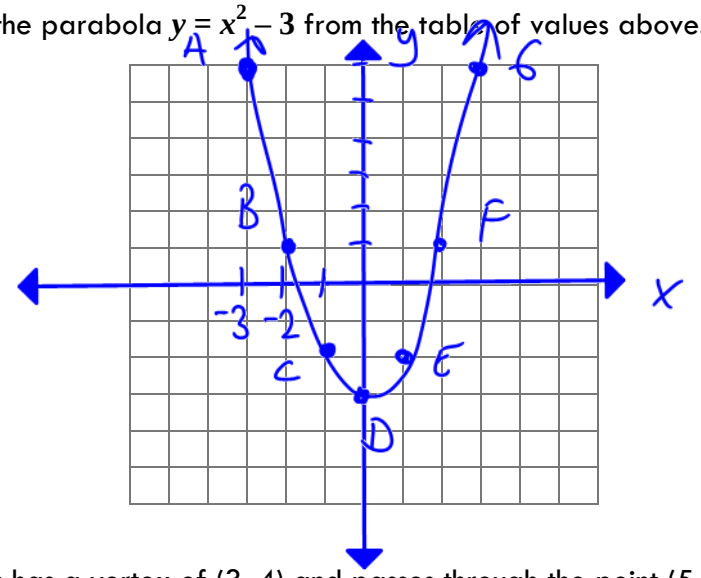
x y

x	$y = x^2 - 3$	$(y_2 - y_1)$ 1st Differences	(1^{st} diff$_2$ – 1^{st} diff$_1$) 2nd Differences
A(−3, 6) −3	$y = (-3)^2 - 3 = 9 - 3 = 6$		
		$1 - 6 = -5$	
B(−2, 1) −2	$y = (-2)^2 - 3 = 4 - 3 = 1$		$-3 - (-5) = -3 + 5 = 2$
		$-2 - 1 = -3$	
C(−1, −2) −1	$y = (-1)^2 - 3 = 1 - 3 = -2$		$-1 - (-3) = -1 + 3 = 2$
		$-3 - (-2) = -3 + 2 = 1$	
D(0, −3) 0	$y = (0)^2 - 3 = 0 - 3 = -3$		$1 - (-1) = 1 + 1 = 2$
		$-2 - (-3) = -2 + 3 = 1$	
E(1, −2) 1	$y = (1)^2 - 3 = 1 - 3 = -2$		$3 - (1) = 2$
		$1 - (-2) = 1 + 2 = 3$	
F(2, 1) 2	$y = (2)^2 - 3 = 4 - 3 = 1$		$5 - 3 = 2$
		$6 - 1 = 5$	
G(3, 6) 3	$y = (3)^2 - 3 = 9 - 3 = 6$		

a) Is this a **quadratic or linear** relationship? How do you know? ❷

It's quadratic because 2nd differences are equal.

b) **Graph** the parabola $y = x^2 - 3$ from the table of values above. **Label the vertex.** ❸



APPLICATION

4. A parabola has a vertex of (3, 4) and passes through the point (5, 8). What is the equation of the quadratic relation? ❸

Step 1 $y = a(x-h)^2 + k$ Given vertex (3, 4) Point (5, 8)

$8 = a(5-3)^2 + 4$ ⟵ sub 'em $h = 3$ $k = 4$ x y

$8 - 4 = a(2)^2$ BEDMAS Step 2

$4 = a \cdot 4$

$\frac{4}{4} = \frac{4a}{4} \Rightarrow \boxed{a = 1}$

$\therefore y = a(x-h)^2 + k$ sub "a", "h", "k"

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

5. A baseball is hit into the air. Its path can be modeled by the relation $h = -2(d-4)^2 + 36$, where h is the height of the ball and d is the horizontal distance, both in meters.

NOTE: This equation can also be written as $y = -2(x-4)^2 + 36$

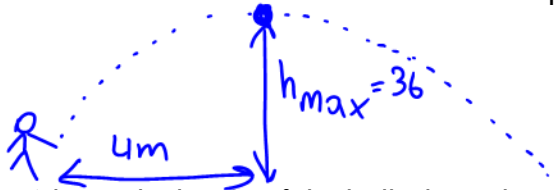
h → k

vertex (h, k)

a) What is the vertex of this relation? ❶

$(4, 36)$ y → vertex $(4, 36)$

b) What do the coordinates of the vertex represent **in this situation**? ❶



The ball reaches its max height of 16m when it travels 4 m. horizontally

c) What is the height of the ball when it has travelled a horizontal distance of 8 m? ❷

Hint: sub in d = 8 and solve for h

$h = -2(d-4)^2 + 36$

$h = -2(8-4)^2 + 36$

$= -2(4)^2 + 36$

$= -2(16) + 36$

$= -32 + 36$

$= 4$

sub 8 for "d"

BEDMAS

∴ The height is 4m.

6. Use the step method to plot the equation $y = -2(x-3)^2 + 8$ on the grid provided below. ❷

1 x -2

Over 1	1 x value of 'a' = −2
Over 1	3 x value of 'a' = −6
Over 1	5 x value of 'a' = −10

-2

-2

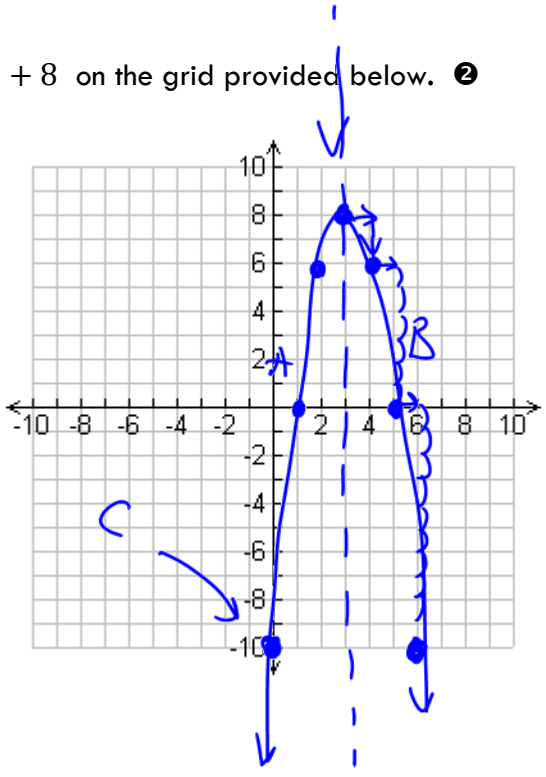
Vertex $(3, 8)$

a) What are the coordinates of the x-intercepts? ❶

A(1,0) B(5,0)

b) What are the coordinates of the y-intercept? ❶

C(0,-10)



7. Complete the table. ❸

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

Equation	Vertex	Step Pattern
$y = 2(x+2)^2 + 3$	(-2, 3)	-2, -6, -10 = a(1, 3, 5)
$y = (x-7)^2 + 16$	(7, 16)	a(1, 3, 5) = 1, 3, 5

h k

-2

a

THINKING

8. True or False: (½ mark each) ❹

x-co of vertex

i. F The axis of symmetry must go through the y – intercept

ii. T The vertex is always located halfway between the zeroes (if there are zeroes)

iii. T The y – coordinate of the vertex is always the same as the optimal value

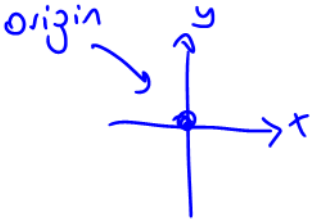
iv. T The axis of symmetry goes through the vertex

v. T The x – coordinate of the vertex is always the same as the axis of symmetry

vi. F A parabola must open up

vii. F The y – intercept is always positive

viii. F The axis of symmetry goes through the origin



9. Suppose you were asked to graph the quadratic relation $y = -\frac{1}{4}(x-9)^2 + 15$. Which graphing method would you use, a table of values or the step method? **Explain** your reasoning. ❷

10. Give two examples of parabolas in real-life. ❷

teeth mouth, the path of a falling object
rainbow, (cotton candies, tonics)
joke