

Name: \_\_\_\_\_

Date: Dec. 7<sup>th</sup>

Knowledge	Application	TIPS	Communication
26 / 26	23 / 23	5 / 8	3 / 3

- Show full solutions for full marks. Leave answers in exact form unless a degree of accuracy is given.
- Communication mark will be based on proper form and use of symbols.

## (KNOWLEDGE)

1. Determine if the following relations are functions. You **MUST** provide a reason for each.

a)  $\{(-1,3), (0,2), (1,5), (2,5)\}$  (2/2)

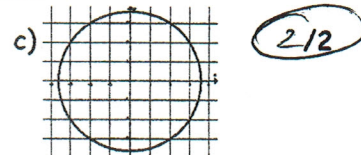
$D = \{-1, 0, 1, 2\}$

∴ Yes this is a function because there is no repeating X-values.

b)  $\{(1,1), (1,4), (3,5), (5,5)\}$  (2/2)

$D = \{1, 3, 5\}$

∴ This is not a function because there is a repeating X-value which is 1.



c) This is not a function because there is repeating X-values. When doing the line test the line usually crosses 2 points at a time.

2. State the following for the quadratics listed:

a)  $y = -(x+3)^2 + 2$  (6/6)

vertex:  $(-3, 2)$

optimum value: Max,  $y=2$

aos:  $x=-3$

opening: Down

$D = \{x \in \mathbb{R}\}$

$R = \{y \leq 2\}$

b)  $y = 3x^2 - 1$  (6/6)

vertex:  $(0, -1)$

optimum value: Min,  $y=-1$

aos:  $x=0$

opening: Up

$D = \{x \in \mathbb{R}\}$

$R = \{y \geq -1\}$

3. Express the following parabolas in vertex form.

a)  $y = x^2 + 28x - 36$  (2/2)

$y = (x^2 + 28x) - 36$

$y = 1(x^2 + 28x) - 36$

$y = 1(x^2 + 28x + 196) - 36 - 196$

$y = 1(x+14)^2 - 232$

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

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

$y = -1(x^2 - 5x) + 2$

$y = -1(x^2 - 5x + 6.25) + 2 + 6.25$

$y = -1(x-2.5)^2 + 8.25$

c)  $y = 4x^2 - 24x + 1$  (2/3)

$y = (4x^2 - 24x) + 1$

$y = 4(x^2 - 6x) + 1$

$y = 4(x^2 - 6x + 9) + 1 - 36$

$y = 4(x-3)^2 - 35$

(APPLICATION)

4. In a soccer game Mr. Serpe easily gets by Torsten by flicking the ball over his head. The path of the ball is modeled by the following parabolic equation  $h = -2.3t^2 + 9.2t + 0.5$  where  $h$  = height in meters and  $t$  = time in seconds. Determine:

a) the initial height of the ball

b) the maximum height of the ball and the time when the maximum occurs

1/1  
4/4

a)  $h = -2.3t^2 + 9.2t + 0.5$

Let  $t = 0$

$h = -2.3(0)^2 + 9.2(0) + 0.5$

$h = 0 + 0 + 0.5$

$h = 0.5\text{m}$

∴ the initial height of the ball was 0.5m.

b)  $h = -2.3t^2 + 9.2t + 0.5$

$h = (-2.3t^2 + 9.2t) + 0.5$

$h = -2.3(t^2 - 4t) + 0.5$

$h = -2.3(t^2 - 4t + 4) + 0.5 + 9.2$

$h = -2.3(t - 2)^2 + 9.7$

$V = (2, 9.7)$

Max height = 9.7m

time = 2 seconds

∴ the maximum height of the ball is 9.7m and it occurs after 2 seconds.

5. LPSS charges \$14.00 per ticket for music night. At this price they sell an average of 2000 tickets. Research shows that every \$0.50 increase in price will result in a drop of 50 ticket sales. Determine the ticket price that maximizes revenue for music night.

Let  $x$  = Amount of increases.

Ticket price =  $(\$14.00 + 0.5x)$

Amount of tickets =  $(2000 - 50x)$

$R = (\text{Ticket price})(\text{Amount of tickets})$

$R = (14.00 + 0.5x)(2000 - 50x)$

$R = 28000 - 700x + 1000x - 25x^2$

$R = -25x^2 + 300x + 28000$

$R = (-25x^2 + 300x) + 28000$

$R = -25(x^2 - 12x) + 28000$

$R = -25(x^2 - 12x + 36) + 28000 + 900$

$R = -25(x - 6)^2 + 28900$

$V = (6, 28900)$

Max Revenue = \$28900

# of Increase = 6

Ticket price =  $(\$14.00 + 0.5x)$

$= (\$14.00 + \$3)$

$= \$17.00$

# of tickets =  $(2000 - 50x)$

$= (2000 - 300)$

$= (1700)$

∴ To maximize revenue LPSS should make music night tickets cost \$17.00.

11

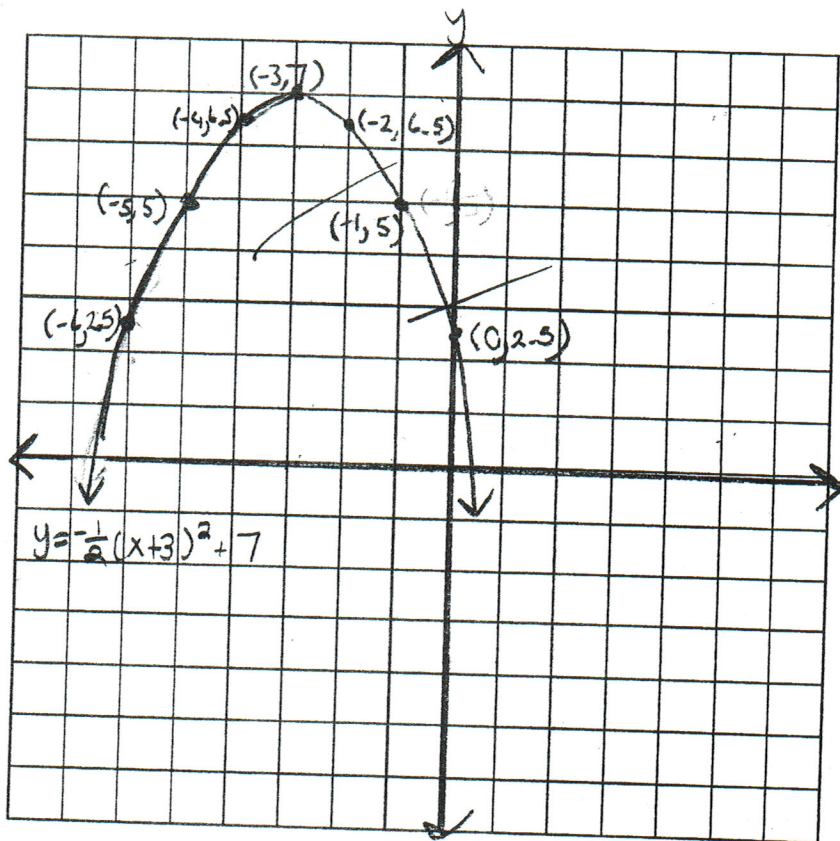


6. State the transformations in words and graph the following quadratics. You must label 7 points for each quadratic. (Choose your scale of position of the x-axis and y-axis appropriately)

a)  $y = -\frac{1}{2}(x+3)^2 + 7$

FD = (1, 3, 5)  
 $= \frac{1}{2}(1, 3, 5)$   
 $= (-0.5, -1.5, -2.5)$

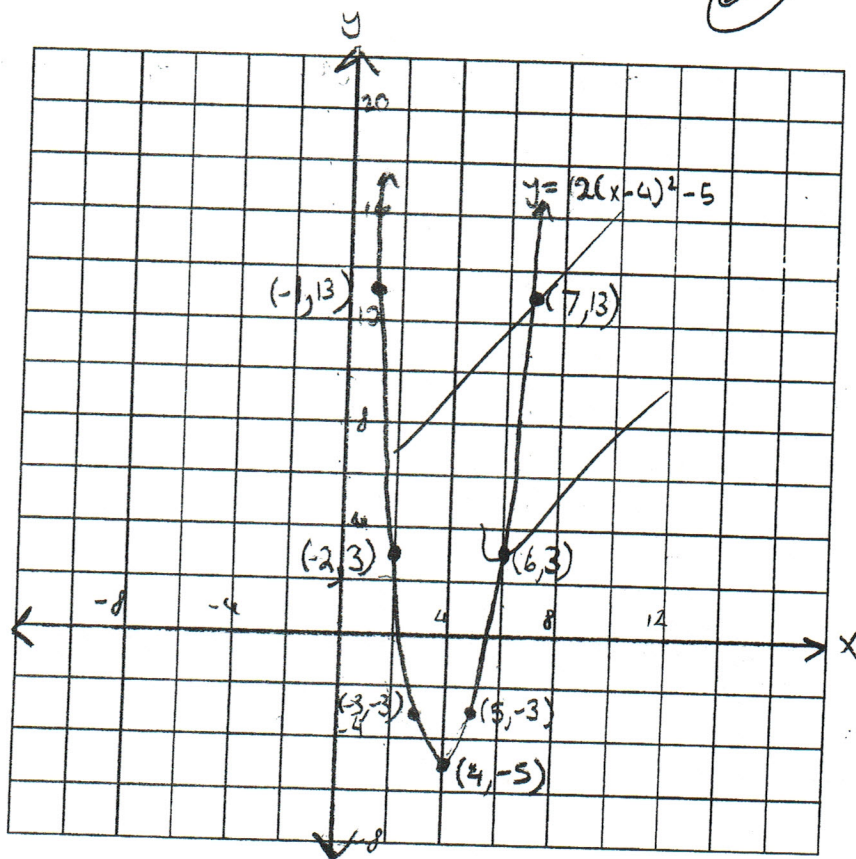
transformation = reflection in the x-axis, vertex compression by factor  $\frac{1}{2}$ , vertex translation up 7 units and horizontal translation 3 units left.



b)  $y = 2(x-4)^2 - 5$

FD = (1, 3, 5)  
 $= 2(1, 3, 5)$   
 $= (2, 6, 10)$

transformations: vertex stretch by factor 2, vertex translation down 5 units, horizontal translation 4 units right.



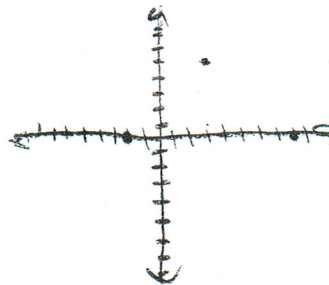
(TIPS)

7. The vertex of the parabola is (3,5). If it intersects the x-axis at the point (8,0), at what other point does it intersect the x-axis at?

$$V = (3, 5)$$
$$X\text{-axis} = (8, 0)$$
$$X\text{-axis} = ?$$

$$8 = 3 + 5$$
$$? = 3 - 5$$
$$? = -2$$

∴ The other point on the X-axis  
(-2, 0)



2/2

8. Determine the value of k so that the graph of  $y = (x+3)^2 + k$  passes through the point (1,20).

$$y = (x+3)^2$$
$$20 = (1+3)^2 + k$$
$$20 = 16 + k$$
$$20 - 16 = k$$
$$4 = k$$

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

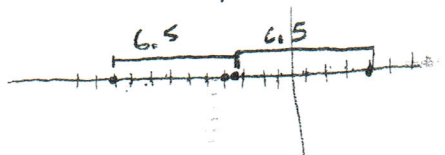
∴ the value of k is 4.

1/1

9. Two points on a parabola are (4, -1) and (-10, -1). What is the equation of the axis of symmetry?

$$P_1 = (4, -1)$$
$$P_2 = (-10, -1)$$

$$\frac{4 + (-10)}{2} = -3$$



$$x = -3$$

∴ the equation of the AOS  
is  $x = -3.5$  → why 3.5?

2/2

10. Determine the equation, in vertex form, of the parabola with vertex (-5, -3) and passing through the point (-3, -11).

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

$$y = \frac{1}{8}(x-5)^2 - 3$$

$$h = -5$$
$$k = -3$$
$$x = -3$$
$$y = -11$$

$$-11 = a(-3-5)^2 - 3$$
$$-11 = a(64) - 3$$
$$-11 + 3 = 64a$$

$$\frac{8}{64} = \frac{64a}{64}$$
$$\frac{1}{8} = a$$

∴ the equation is  $y = \frac{1}{8}(x-5)^2 - 3$

3/3