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COMMUNICATION	Level

Name: ANSWERS

UNIT 3: GRAPHS OF QUADRATIC RELATIONS

KNOWLEDGE

1. Examine the parabola on the right.

a) What are the coordinates of the vertex? $(-2, -4)$ ✓

b) What is the optimum value? -4 ✓

c) Direction of opening? up ✓

d) Maximum or Minimum? Minimum ✓

e) What is the equation of the axis of symmetry? $x = -2$ ✓

f) What are the zeros of the relation? $(-4, 0)$ and $(0, 0)$ ✓

g) If you calculated the second differences, what would their sign be? positive ✓

h) Determine the equation in factored form and standard form.

$$\begin{aligned} r &= -4 \\ s &= 0 \\ x &= -2 \\ y &= -4 \\ a &= ? \end{aligned}$$

$$\begin{aligned} y &= a(x-s)(x-r) \\ (-4) &= a(-2-0)(-2-(-4)) \\ -4 &= a(-2)(2) \quad \checkmark \end{aligned}$$

$$\begin{aligned} -4 &= -4a \\ -4 &= -4a \end{aligned}$$

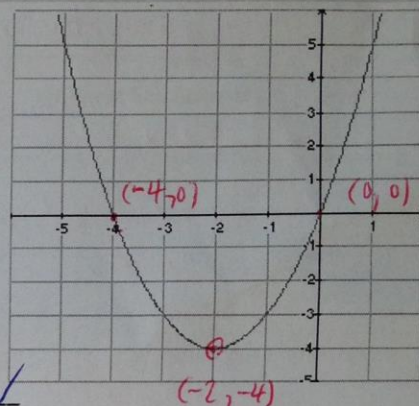
$$1 = a \quad \checkmark$$

$$\begin{aligned} y &= a(x-s)(x-r) \\ y &= (1)(x-0)(x-(-4)) \quad \checkmark \end{aligned}$$

$$y = x(x+4)$$

$$y = x^2 + 4x \quad \checkmark$$

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2. Given each table of values below, determine if the relation is linear, quadratic or neither.

a.) $y = 2x^2 - 1$

x	y	1 st Differences	2 nd Differences
-4	31		
-3	17	-14 ✓	
-2	7	-10	+4 ✓
-1	1	-6	+4
0	-1	-2	+4

∴ Quadratic ✓

b.) $y = -3x + 4$

x	y	1 st Differences	2 nd Differences
-4	16		
-3	13	-3 ✓	
-2	10	-3	
-1	7	-3	
0	4	-3	

∴ linear ✓

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3. Using the degree of each polynomial, determine if the relation is linear, quadratic or neither.

a.) $4x(5x+6)$
 $= 20x^2 + 24x$ ✓
 $\text{deg} = 2$ ✓
 $\therefore$ quadratic ✓

b.) $3x^2(2x+5)$
 $= 6x^3 + 15x^2$ ✓
 $\text{deg} = 3$ ✓
 $\therefore$ neither ✓

c.) $3x+6$
 $\text{deg} = 1$ ✓
 $\therefore$ linear ✓

4. Expand and simplify.

a.) $(x+1)(x-4)$
 $= x^2 - 4x + x - 4$ ✓
 $= x^2 - 3x - 4$ ✓

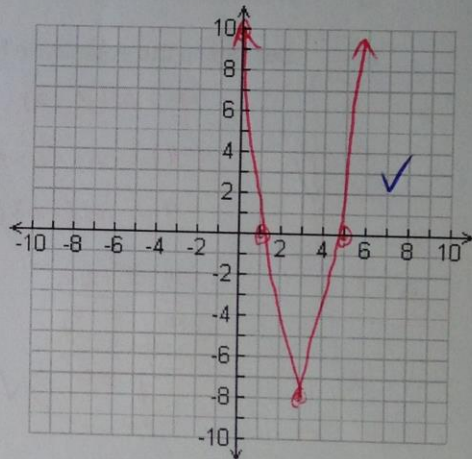
b.) $2(4x-1)(3x+2)$
 $= (8x-2)(3x+2)$ ✓
 $= 24x^2 + 16x - 6x - 4$ ✓
 $= 24x^2 + 10x - 4$ ✓

c.) $(2x+1)^2 - 5$
 $= (2x+1)(2x+1) - 5$ ✓
 $= 4x^2 + 2x + 2x + 1 - 5$ ✓
 $= 4x^2 + 4x - 4$ ✓

5. For the equation $y = 2(x-1)(x-5)$, find the x-intercept(s), y-intercept, vertex and then sketch the graph.

x-ints, $y=0$ ✓
 $0 = 2(x-1)(x-5)$
 $0 = (x-1)(x-5)$
 $x=1$ ✓ $x=5$ ✓
y-int, $x=0$ ✓
 $y = 2(0-1)(0-5)$
 $y = 2(-1)(-5)$
 $y = 10$ ✓

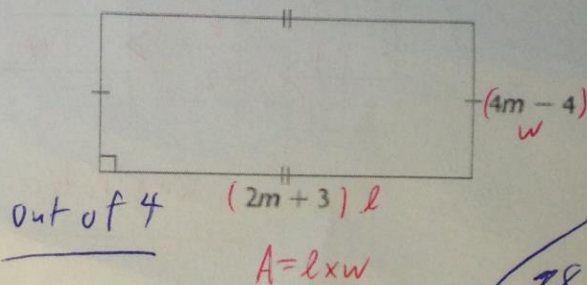
x of vertex $= \frac{1+5}{2}$
 $= 3$ ✓
y of vertex $y = 2(3-1)(3-5)$
 $y = 2(2)(-2)$
 $y = -8$ ✓
 $\therefore$ x-ints are $(1, 0)$ & $(5, 0)$
 y-int is $(0, 10)$
 vertex is $(3, -8)$



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6. Write a simplified expression for the area of the figure.

$A = l \times w$ ✓
 $A = (2m+3)(4m-4)$ ✓
 $A = 8m^2 - 8m + 12m - 12$ ✓
 $A = 8m^2 + 4m - 12$ ✓



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$A = l \times w$

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APPLICATION

1. A ball is thrown into the air from the roof of a building that is 25 m high. The ball reaches a maximum height of 45 m above the ground after 2 s and hits the ground 5 s after being thrown.

- a.) What are the zeros of the relation?

$$(5, 0) \text{ \& } (-1, 0) \leftarrow \text{see graph}$$

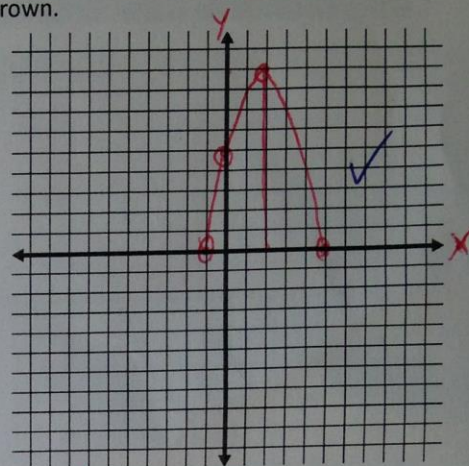
- b.) What is the y-intercept?

$$(0, 25)$$

- c.) Determine the coordinates of the vertex.

$$(2, 45)$$

- d.) Sketch a graph of the relation.



- e.) Determine an equation for the relation in factored form.

$$\begin{aligned} s &= 5 \\ r &= -1 \\ x &= 0 \\ y &= 25 \\ a &= ? \end{aligned}$$

$$y = a(x-s)(x-r)$$

$$(25) = a(0-5)(0-(-1))$$

$$25 = a(-5)(1)$$

$$\frac{25}{-5} = \frac{-5a}{-5}$$

$$-5 = a$$

$$\therefore y = -5(x+1)(x-5)$$

x-values by 1
y-values by 5

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2. A local bowling alley charges \$5 and averages 400 customers on Friday nights. Over the past several months, the manager changed the cover charge several times to see how it affected the number of customers. The manager found that for every increase of \$0.50 in the cover charge, the number of customers decreased by 25.

- a.) Write an algebraic expression to model revenue. Define your variables.

- b.) Use the above relation to determine the ticket price that maximizes revenue?

a.) Let y be the revenue
Let x be the # of increases

$$\text{cost per ticket} = (5 + 0.5x)$$

$$\text{\# of customers} = (400 - 25x)$$

$$\text{revenue} = (\text{cost per ticket})(\text{\# of customers})$$

$$y = (5 + 0.5x)(400 - 25x)$$

b.) Let $y = 0$

$$0 = (5 + 0.5x)(400 - 25x)$$

$$0 = 5 + 0.5x$$

$$\frac{-5}{0.5} = \frac{0.5x}{0.5}$$

$$-10 = x$$

$$0 = 400 - 25x$$

$$\frac{-400}{-25} = \frac{-25x}{-25}$$

$$16 = x$$

$$\therefore x \text{ of vertex} = \frac{-10 + 16}{2} = 3 \rightarrow \text{max \# of increases}$$

$$\begin{aligned} \therefore \text{cost of ticket} &= (5 + 0.5x) \\ &= 5 + 0.5(3) \\ &= 6.50 \end{aligned}$$

$\therefore \$6.50$ ticket price will max. revenue

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