Review

Unit 6 – Applications of Quadratic Relations

1. Solve each of the following using the **quadratic formula**. Round to two decimal places if necessary. a=1 b=-2 c=1 a=2 b=-3 c=1 $x=\frac{-(-3) \mp \sqrt{(-3)^2 - 4(2)(1)}}{2(2)}$ $=\frac{4 \mp \sqrt{0}}{2}$ $x = -\frac{4 \mp \sqrt{0}}{2}$ $=\frac{3 \mp \sqrt{-79}}{4}$ $x = -\frac{4}{2} = 2$ no solutions

c.
$$2d^{2} = -7d$$

 $2d^{2} + 7d = 0$ $a = 2$ $b = 7$ $c = 0$
 $x = \frac{-7 \mp \sqrt{(7)^{2} - \sqrt{(2)(0)}}}{2^{(2)}}$
 $= \frac{-7 \mp \sqrt{49}}{4} = \frac{-7 \mp 7}{4}$
 $\int_{-3.5}^{-7.7} \sqrt{9}$

2. Solve each of the following by **factoring**.

a.
$$x^{2}+3x-40=0$$

 $(x-5)(x+8)=0$ -40 +3 - 5, +8
 $x-5=0$ $x+8=0$
 $x=5$ $(x=8]$
 $z=8$

d.
$$(x-1)(x+3) = 6$$

 $x^{2}+2x-3=6$
 $y^{2}+2x-3-6=0$
 $(x^{2}+2x-3-6=0)$
 $(x^{2}+2x-9=0)$
 $x = \frac{-2\mp\sqrt{(2)^{2}-4(1)(-9)}}{2(1)}$
 $z = -\frac{2\mp\sqrt{(2)^{2}-4(1)(-9)}}{2(1)}$
 $z = -\frac{2\mp6.3}{2}$
 $y = -2\pm6.3 = -4.15$
 $z = -4.15$

$$4a^{2}-6a-6a+7=5 \qquad 36 \text{ fm} l^{-6} l^{-6} l^{-1}$$

$$2a(2a-3)-3(2a-3)=7 \qquad 121$$

$$(2a-3)(2a-3)=7 \qquad 312$$

$$4 q$$

$$2a-3=7 \qquad 23 l^{-2} l^{-2}$$

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3. Determine the vertex of each parabola by completing the square: a. $y = -3x^2 - 30x - 80$ b. y = 4.

$$=-3(x^{2}+10x)-80$$

$$=-3(x^{2}+10x+25-75)-80$$

$$=-3(x^{2}+10x+25)+75-80$$

$$=-3(x+5)^{2}-5$$
Vertex is $(-5,-5)$

y =
$$4x^2 - 16x + 9$$

y = $4(x^2 - 4x) + 9$
= $4(x^2 - 4x) + 9$
= $4(x^2 - 4x + 4 - 4) + 9$
= $4(x^2 - 4x + 4) - 16 + 9$
= $4(x - 2)^2 - 7$
Vertex is $(2, -7)$

c.
$$y = 4x^{2} - 8x - 35$$

 $= 4(x^{2} - 2x) - 35$
 $= 4(x^{2} - 2x + 1 - 1) - 35$
 $= 4(x^{2} - 2x + 1) - 4 - 35$
 $= 4(x - 1)^{2} - 39$
 $= \sqrt{er+ex}$ is $(1, -39)$

d.
$$y = -2x^{2} + 12x - 1$$

 $= -2(x^{2} - 6x) - 1$
 $= -2(x^{2} - 6x + 9 - 9) - 1$
 $= -2(x^{2} - 6x + 9) + 18 - 1$
 $= -2(x^{-3})^{2} + 17$
Vertex is $(3, 17)$

4. Determine the vertex of each parabola by **averaging the zeros**:

a.
$$y = x^{2} + 7x - 30$$

b. $y = 5x^{2} - 15x$
c. $y = \frac{-16 + 3}{x} = -6.5$
 $y = (4.5 - 3)(4.5 + 14)$
 $= (3.5 \times 1065)$
 $= 57.7 \times 10^{-1}$
 $y = (4.5 - 3)(4.5 + 14)$
 $= (3.5 \times 1065)$
 $= 57.7 \times 10^{-1}$
 $y = (2.5 - 3)(4.5 + 14)$
 $= (3.5 \times 1065)$
 $= 57.7 \times 10^{-1}$
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 $y = (2.5 - 3)(4.5 + 14)$
 $= 57.7 \times 10^{-1}$
 $y = (2.5 - 3)(4.5 + 14)$
 $y = 2x^{2} + x - 10$
 $y = 2x^{2} - 4x + 5x - 10$
 $y = 2x^{2} - 4x + 5x - 10$
 $y = 2x^{2} - 4x + 5x - 10$
 $y = (2.2 - 2)(2x + 5)$
 $y = (2.2 - 5)(2x + 5)(2x + 5)(2x + 5)$
 $y = (2.2 - 5)(2x + 5)(2x + 5)(2x + 5)(2x + 5)(2x + 5)(2x + 5)(2x$

5. Find the **x** intercepts, vertex, and **y**-intercept of the quadratic relation below. Graph the relation on the grid provided without using a table of values. Label the axes and curve



6. Mrs. Mulock hits a golf ball off a tee. Its height above the ground can be approximated by using the equation $h = -4t^2 + 16t$, where *h* is the height above the ground in metres and *t* is the time in seconds. What is the maximum height of the golf ball? After how many seconds does this occur?

$$h = -4(t^{2} - 4t) \xrightarrow{-4}{2} = -2 \quad (-2)^{2} = 4$$

$$= -4(t^{2} - 4t + 4 - 4)$$

$$= -4(t^{2} - 4t + 4) + 16$$

$$= -4(t - 2)^{2} + 16$$

$$Vertex is (2, 16) \xrightarrow{-1}{1} te ball reach its max height of 16m'
in 2 sec.$$

- 7. Mr. Mulock works on weekends selling thingamajigs. The profit he earns is determined by the equation $P = -3n^2 + 72n 310$, where *n* is the number of thingamajigs sold and *P* is the profit in dollars.
 - a. What is the maximum profit that Mr. Mulock can earn?
 - b. Is it possible for Mr. Mulock to obtain a profit of \$200? Show all work to justify your answer.

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Review

- 8. When Mr. Math realized that he had superpowers, he decided to try them out. He took a basketball and threw it into the air. Mrs. Math watched Mr. Math throw the ball and saw that it took the shape of a parabola with its height, 'h' in metres, being related to its time in the air, 't' seconds, by the equation $h = -5t^2 + 60t + 2$
 - a. If the ball's starting position was at the top of Mr. Math's head, how tall is Mr. Math?
 - b. What is the maximum height of the ball?
 - c. When does the ball reach its maximum height?

9.2m (y-m+) $h_{1} = -5(t^{2}-12t) + 2 - \frac{12}{2} = -6(-6)^{2} = -36$ $= -5(t^2-12t+36-36)+2$ $= -5(t-6)^{2} + 180+2$ $=-5(t-6)^{2}+182$. Max height is 182m.

C. It reaches in 6 sec.

 9. A farmer's field borders a stream. The farmer has 300 m of fencing to build a rectangular enclosure alongside the stream (so he only needs to build three sides). The area of the field is given by A-x (300-2w) where w is the length of the two matching sides. Draw a labelled diagram to represent the enclosure, and find the maximum area the farmer could enclose.

$$A = C \quad \omega$$

$$= -2\omega + 300$$

$$A = C \quad \omega$$

$$= -2\omega^{2} + 300 \quad \omega$$

$$= -2(\omega^{2} - 150\omega)$$

$$= -2(\omega^{2} - 150\omega + 5625 - 5625)$$

10. The backboard behind a basketball net is a rectangle whose area can be represented by the trinomial $A = 3x^2 + 35x + 22$ (remember, the area of a rectangle is $A = (L) \times (W)$). Determine the two expressions that represent the length and width.

$$A = 3x^{2} + 33x + 2x + 22 \qquad \frac{M}{6} \frac{A}{37} \frac{N}{12} + \frac{N}{12}$$

= 3x (x+11)+2(x+11)
$$A = (3x+2)(x+11)$$

$$\therefore 3x+2 \quad \text{ond} \quad x+11 \quad \text{ore} \quad \text{the climensions}.$$

Unit 6 – Applications of Quadratic Relations

11. Astronauts have performed various experiments while on the moon. In one of their experiments, a projectile was launched and observed. The projectile reached a maximum height of 21 m and landed on the surface of the moon after 3.8 sec. Select the equation for the height, h, in metres, of the projectile after t seconds.

$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \end{array} \\ h = -5 \ (t - 1.9)^2 + 21 \\ \end{array} \\ d. \end{array} \\ \begin{array}{c} \begin{array}{c} \\ \end{array} \\ h = -5 \ (t + 1.9)^2 + 21 \end{array} \end{array} $
(sec)

12. A water balloon was tossed in the air, and of course Mr. Culhane came up with a quadratic equation that models the total horizontal distance (in metres) covered throughout the flight of the balloon. The equation he came up with was $-0.6d^2 + 3.25d = -7.1$. Determine the horizontal distance covered by this toss by solving the equation above. Round your answer to two decimal places. $-0.6d^2 + 3.25d + 7.1 = 0$

$$\begin{aligned} & Q = 0.6 \quad b = 3.25 \quad c = -7.1 \\ & X = \frac{-3.25 \mp \sqrt{(3.25)^2 - 4(0.6)(47.1)}}{2(0.6)} \\ & = \frac{-3.25 \mp \sqrt{27.6025}}{-1.2} \\ & = \frac{-3.25 \mp 5.3}{-1.2} \\ & X_1 = \frac{-3.25 \mp 5.3}{-1.2} \\ & X_2 = \frac{-3.25 - 5.3}{-1.2} \\ & X_2 = \frac{-3.25 - 5.3}{-1.2} \end{aligned}$$

. The ball covered 7.1m