Math 20-2

KEY

L25 – Worksheet

Part 1a – Finding Zeroes in Standard Form using Factoring

Q1: With the equation $f(x) = 2x^2 + 4x - 6$, the zeroes are located at x_1 = ***-a*** and x_2 = ***b***, where ***a*** and ***b*** are ___ and ___.

*(Record your **two-digit** answer in the Numerical Response boxes below)*

3	1		

$0 = 2(x^2 + 2x - 3)$

$0 = 2(x+3)(x-1)$

$x+3 = 0$ $\quad$ $x-1 = 0$

$x = -3$ $\quad$ $x = 1$

Q2: With the equation $y = 2x^2 - 3x - 9$, the zeroes are located at $x_1 = -\frac{a}{b}$ and x_2 = ***c***, where ***a, b,*** and ***c*** are ___, ___, and ___.

*(Record your **three-digit** answer in the Numerical Response boxes below)*

3	2	3	

$0 = 2x^2 - 3x - 9$

$0 = 2x^2 + 3x - 6x - 9$

$0 = (2x^2 + 3x) + (-6x - 9)$

$0 = x(2x+3) - 3(2x+3)$

$0 = (2x+3)(x-3)$

$2x+3 = 0$ $\quad$ $x-3 = 0$

$x = -3/2$ $\quad$ $x = 3$

+3 −6

□ + □ = −3

□ × □ = −18

1, 18
2, 9
3, 6

Part 1b – Solving Equations in Standard Form using Factoring

Q3: Solve $x^2 = 2x + 15$ using factoring. *(1 mark)*

$-2x \quad -2x$

$x^2 - 2x = 15$

$-15 \quad -15$

$x^2 - 2x - 15 = 0$

$(x-5)(x+3) = 0$

$x - 5 = 0$ $\quad$ $x + 3 = 0$

$x = 5$ $\quad$ $x = -3$

Q4: Solve $x^2 + x = 6$ using factoring. *(1 mark)*

$-6 \quad -6$

$x^2 + x - 6 = 0$

$(x+3)(x-2) = 0$

$x + 3 = 0$ $\quad$ $x - 2 = 0$

$x = -3$ $\quad$ $x = 2$

KEY

Part 2 – Finding Zeroes in Vertex Form

Q5: Determine the zeroes of the function $f(x) = (x-2)^2 - 6$ algebraically. *(1 mark)*

$0 = (x-2)^2 - 6$

$+6 \qquad +6$

$6 = (x-2)^2$

$\sqrt{6} = x-2$

$+\sqrt{6} = x-2 \qquad -\sqrt{6} = x-2$

$+2 \quad +2 \qquad +2 \quad +2$

$x_1 = \sqrt{6}+2 \qquad x_2 = -\sqrt{6}+2$

Q6: Given the equation $y = -\frac{1}{2}(x-2)^2 + 3$, determine the zeroes algebraically. *(2 marks)*

$0 = -\frac{1}{2}(x-2)^2 + 3$

$-3 \qquad -3$

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

$\div(-\frac{1}{2}) \quad \div(-\frac{1}{2})$

$6 = (x-2)^2$

$\sqrt{6} = x-2$

$+\sqrt{6} = x-2 \qquad -\sqrt{6} = x-2$

$+2 \quad +2 \qquad +2 \quad +2$

$\sqrt{6}+2 = x_1 \qquad -\sqrt{6}+2 = x_2$

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Part 3a – Finding Zeroes in Standard Form using Quadratic Equation

Q7: Determine the zeroes of the function $f(x) = 2x^2 + 4x - 1$ using the Quadratic Equation. Give your answer as an exact value. *(2 marks)*

$y = ax^2 + bx + c$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(2)(-1)}}{2(2)}$$

$$x = \frac{-4 \pm \sqrt{24}}{4}$$

$$x = \frac{-4 \pm 2\sqrt{6}}{4}$$

$$x = -1 \pm \tfrac{1}{2}\sqrt{6}$$

$x_1 = -1 + \frac{1}{2}\sqrt{6}$ $\quad$ $x_2 = -1 - \frac{1}{2}\sqrt{6}$

24 → 2, 12 → 2, 6 → 2, 3

$\sqrt{24} = \sqrt{2^2 \cdot 2 \cdot 3} = 2\sqrt{6}$

Q8: Determine the zeroes of the function $f(x) = -3x^2 - 5x + 6$ using the Quadratic Equation. Give your answer as an exact value. *(2 marks)*

$y = ax^2 + bx + c$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(-3)(6)}}{2(-3)}$$

$$x = \frac{5 \pm \sqrt{25 + 72}}{-6}$$

$$x = \frac{5 \pm \sqrt{97}}{-6}$$

$x_1 = \frac{5 + \sqrt{97}}{-6}$ $\quad$ $x_2 = \frac{5 - \sqrt{97}}{-6}$

KEY

Part 3b – Solving Equations in Standard Form using Quadratic Equation

Q9: Solve the equation $2x^2 + 4x = 6$ using the Quadratic Equation. *(2 marks)*

$-6 \quad -6$

$2x^2+4x-6=0$

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \dfrac{-4 \pm \sqrt{4^2-4(2)(-6)}}{2(2)}$

$x = \dfrac{-4 \pm \sqrt{64}}{4}$

$x = \dfrac{-4 \pm 8}{4}$

$x_1 = \dfrac{-4+8}{4}$ $\qquad$ $x_2 = \dfrac{-4-8}{4}$

$x_1 = 1$ $\qquad$ $x_2 = -3$

Q10: Solve the equation $5x^2 = x + 2$ using the Quadratic Equation. *(2 marks)*

$-x \quad -x$

$5x^2-1x=2$

$-2 \quad -2$

$5x^2-1x-2=0$

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \dfrac{-(-1) \pm \sqrt{(-1)^2-4(5)(-2)}}{2(5)}$

$x = \dfrac{1 \pm \sqrt{1+40}}{10}$

$x = \dfrac{1 \pm \sqrt{41}}{10}$

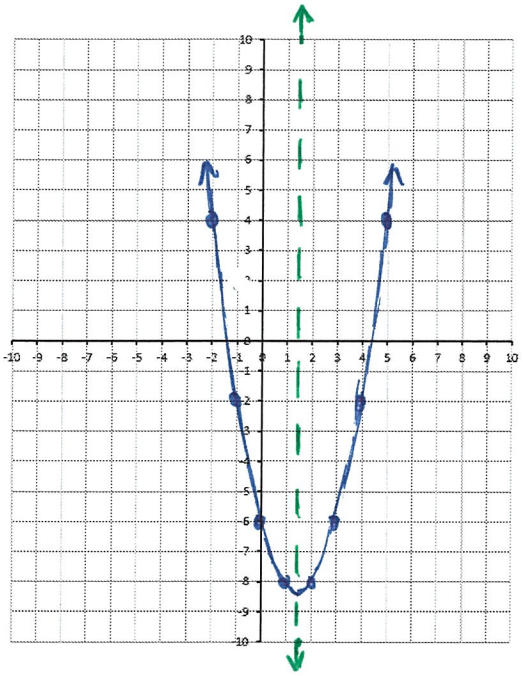
$x_1 = \dfrac{1+\sqrt{41}}{10}$ $\qquad$ $x_2 = \dfrac{1-\sqrt{41}}{10}$

$x_1 \approx 0.74$ $\qquad$ $x_2 \approx -0.54$

KEY

Part 4a – Finding Zeroes using Graphing

Q11: Determine the zeroes (approximate value) of the function $y = x^2 - 3x - 6$ by graphing the function. *(2 marks)*



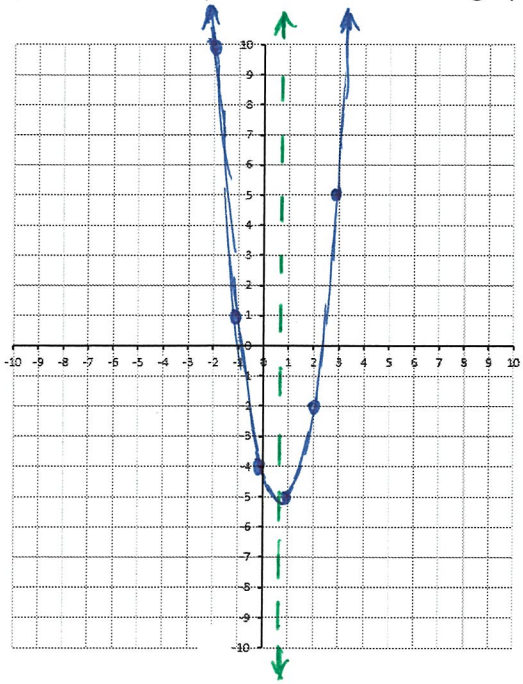
y-intercept = -6
Vertex = (1.50, -8.25)
Axis of symmetry x = 1.50

x	y
-2	4
-1	-2
0	-6
1	-8
2	-8
3	-6
4	-2
5	4

$x \approx -1.4, 4.4$

Part 4b – Solving Equations using Graphing

Q12: Solve the equation $2x^2 = 3x + 4$ graphically. *(3 marks)*



$2x^2 - 3x - 4 = 0$
Graph $y = 2x^2 - 3x - 4$ and look for zeroes.

Vertex at (0.75, -5.13)
y-intercept y = -4
Axis of symmetry x = 0.75

x	y
-2	10
-1	1
0	-4
1	-5
2	-2
3	5
4	16

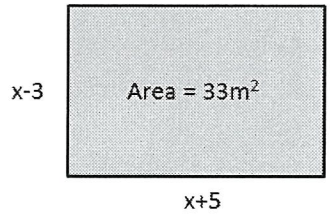
$x \approx -0.9, 2.4$

Math 20-2 KEY

Area Problems

Use the following information to answer Q13:

A patio has a total area of $33m^2$, and is proportioned per the diagram below.



Q13: Set up a quadratic equation and solve to determine the value(s) of ***x***. *(1 mark)*

$A(x) = (x-3)(x+5)$

$33 = x^2+2x-15$

$-33 \qquad -33$

$0 = x^2+2x-48$

$0 = (x+8)(x-6)$

$x=-8 \qquad x=6$

Can't have negative side length, so $\boxed{x=6}$ is the only value that works.

Q14: A slightly smaller patio has the same proportions, but has a total area of $30m^2$. Determine the value of ***x***, to the nearest tenth. *(1 mark)*

(Record your answer in the Numerical Response boxes below)

5	.	8	

$A(x) = x^2+2x-15$

$30 = x^2+2x-15$

$-30 \qquad -30$

$0 = x^2+2x-45$

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \dfrac{-2 \pm \sqrt{2^2-4(1)(-45)}}{2(1)}$

$x = \dfrac{-2 \pm \sqrt{184}}{2}$

$x_1 = \dfrac{-2+\sqrt{184}}{2} \qquad x_2 = \dfrac{-2-\sqrt{184}}{2}$

$x_1 \approx 5.8 \qquad x_2 \approx -7.8$

Results in positive side lengths.

Math 20-2 KEY

Projectile Motion

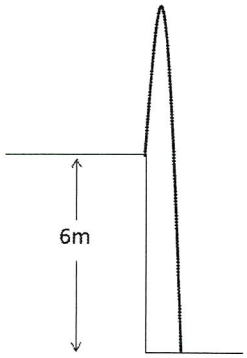
Use the following information to answer Q15:

An object is launched vertically at 13m/s off a 6m tall ledge. The *Physics 20* equation that can be used to determine time is given by:

$$\Delta d = v_i t + \frac{1}{2}at^2$$

Where the acceleration due to gravity is approximately -10 m/s^2. In Math 20-1, we can write this function as follows:

$$h(t) = -5t^2 + 13t + 6$$



Q15: How long does it take the object to land? Support your work algebraically. *(2 marks)*

Using Factoring

$0 = -5t^2+13t+6$

$\div(-1)\ \div(-1)\ \div(-1)\ \div(-1)$

$0 = 5t^2-13t-6$

+2 −15
□+□ = −13
□×□ = −30

$0 = 5t^2+2t-15t-6$

$0 = (5t^2+2t)+(-15t-6)$

$0 = t(5t+2)-3(5t+2)$

$0 = (5t+2)(t-3)$

$5t+2=0$ $\quad$ $t-3=0$

$t = -2/5$ $\quad$ $\boxed{t=3}$

It takes 3sec to hit the ground.

Using Quadratic

$h(t) = -5t^2+13t+6$

$0 = -5t^2+13t+6$

$t = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

$t = \dfrac{-13 \pm \sqrt{13^2-4(-5)(6)}}{2(-5)}$

$t = \dfrac{-13 \pm \sqrt{289}}{-10}$

$t_1 = \dfrac{-13+\sqrt{289}}{-10}$ $\quad$ $t_2 = \dfrac{-13-\sqrt{289}}{-10}$

$t_1 = \dfrac{-13+17}{-10}$ $\quad$ $t_2 = \dfrac{-13-17}{-10}$

$t_1 = -2/5$ $\quad$ $\boxed{t_2 = 3}$

It takes 3sec to hit the ground.