U2D1 MCR3UI **Worksheet Radicals (Extra Practice) NO CALCULATORS!**

A. Simplify the following, always expressing answers in simplest form.

1. $\sqrt{8bc} \times \sqrt{4bc}$
2. $3\sqrt{20} \times 6\sqrt{5}$
3. $5 \times 2\sqrt{6}$
4. $5\sqrt{10} \times \sqrt{4}$
5. $\sqrt{5b} \times \sqrt{5b}$
6. $\sqrt{2a} \times \sqrt{6a}$
7. $\frac{1}{3}\sqrt{3} \times \sqrt{3}$
8. $\frac{1}{4}\sqrt{20} \times \frac{4}{5}\sqrt{5}$
9. $\sqrt{ax} \times \sqrt{ax}$
10. $\sqrt{ab^3} \times \sqrt{ac^3}$
11. $\sqrt{6r^4} \times \sqrt{3rs^2}$
12. $\sqrt{2c^3} \times \left(-\sqrt{5cd}\right)$
13. $2m\sqrt{7mn} \times 3\sqrt{7m}$
14. $\left(\sqrt{5}\right)^2$
15. $\left(4\sqrt{6}\right)^2$
16. $3y\sqrt{6x^3y} \times 2x\sqrt{8xy^4}$
17. $\left(-2\sqrt{x}\right)^2$
18. $\left(x\sqrt{2a}\right)^2$
19. $5\sqrt[3]{45} \times 2\sqrt[3]{3}$
20. $\sqrt[4]{18} \times \sqrt[4]{9}$
21. $\sqrt[5]{486}$
22. $2\left(4\sqrt{2}+1\right)$
23. $2\left(3\sqrt{12}-5\sqrt{8}\right)$
24. $\sqrt{2}\left(\sqrt{3}+3\right)$
25. $\sqrt{8}\left(2\sqrt{3}-5\right)$
26. $\sqrt{6}\left(\sqrt{2}-\sqrt{12}\right)$
27. $\sqrt{2}\left(3\sqrt{2}+\sqrt{18}\right)$
28. $\sqrt{12}\left(2\sqrt{5}-4\sqrt{2}\right)$
29. $\left(\sqrt{2}+4\right)\left(\sqrt{2}-4\right)$
30. $\left(2\sqrt{3}-3\right)\left(2\sqrt{3}+3\right)$
31. $\left(\sqrt{3}+4\right)\left(\sqrt{3}+2\right)$
32. $\left(5+3\sqrt{3}\right)\left(5+3\sqrt{3}\right)$
33. $\left(2\sqrt{3}-1\right)^2$
34. $\left(\sqrt{2}+\sqrt{3}\right)^2$
35. $\left(5\sqrt{6}-6\sqrt{5}\right)^2$
36. $\left(6\sqrt{5}+\sqrt{7}\right)\left(6\sqrt{5}-\sqrt{7}\right)$
37. $\sqrt{\frac{3}{4}}$
38. $\sqrt{\frac{15}{64}}$
39. $\sqrt{\frac{24}{25}}$
40. $\sqrt{2\frac{1}{4}}$
41. $\sqrt[3]{\frac{500}{4}}$
42. $\sqrt{\frac{d}{m^2}}$
43. $\sqrt{\frac{4x^2y}{121a^8b^6}}$

B. Simplify.

1. $2\sqrt{36}+2\sqrt{64}-5\sqrt{12}$
2. $4\sqrt{75}+8\sqrt{12}-3\sqrt{48}$
3. $7\sqrt{120}-3\sqrt{52}-2\sqrt{28}$
4. $8\sqrt{24}+3\sqrt{6}-4\sqrt{54}$
5. $4\sqrt{243}+2\sqrt{363}-5\sqrt{49}$
6. $7\sqrt{45}+4\sqrt{196}-6\sqrt{125}$
7. $4\sqrt[3]{54}-7\sqrt[3]{128}+2\sqrt[3]{24}$
8. $5\sqrt[3]{375}+2\sqrt[3]{192}-\sqrt[3]{24}$
9. $2\sqrt[4]{48}-\sqrt[4]{243}$

ANSWERS:

Part A:

1. $4bc\sqrt{2}$
2. 180
3. $10\sqrt{6}$
4. $10\sqrt{10}$
5. $5b$
6. $2a\sqrt{3}$
7. 1
8. 2
9. ax
10. $abc\sqrt{bc}$
11. $3r^2s\sqrt{2r}$
12. $-c^2\sqrt{10d}$
13. $42m^2\sqrt{n}$
14. 5
15. 96
16. $24x^3y^3\sqrt{3y}$
17. $4x$
18. $2ax^2$
19. $30\sqrt[3]{5}$
20. $3\sqrt[4]{2}$
21. $3\sqrt[5]{2}$
22. $8\sqrt{2}+2$
23. $12\sqrt{3}-20\sqrt{2}$
24. $\sqrt{6}+3\sqrt{2}$
25. $4\sqrt{6}-10\sqrt{2}$
26. $2\sqrt{3}-6\sqrt{2}$
27. 12
28. $4\sqrt{15}-8\sqrt{6}$
29. -14
30. 3
31. $6\sqrt{3}+11$
32. $52+30\sqrt{3}$
33. $13-4\sqrt{3}$
34. $5+2\sqrt{6}$
35. $330-60\sqrt{30}$
36. 173
37. $\frac{\sqrt{3}}{2}$
38. $\frac{\sqrt{15}}{8}$
39. $\frac{2\sqrt{6}}{5}$
40. $\frac{3}{2}$
41. 5
42. $\frac{\sqrt{d}}{m}$
43. $\frac{2x\sqrt{y}}{11a^4b^3}$

Part B:

1. $28-10\sqrt{3}$
2. $24\sqrt{3}$
3. $14\sqrt{30}-6\sqrt{13}-4\sqrt{7}$
4. $7\sqrt{6}$
5. $58\sqrt{3}-35$
6. $56-9\sqrt{5}$
7. $-16\sqrt[3]{2}+4\sqrt[3]{3}$
8. $31\sqrt[3]{3}$
9. $\sqrt[4]{3}$

U2D2 MCR 3UI **Worksheet** **Function Notation**

1. Write in function notation.
   a) $y = 5x - 3$ b) $C = 45n - 200$ c) $W = 15h$ d) $A = 4\pi r^2 - 12r + 2$

2. Write as an equation with two variables.
   a) $f(x) = 2x + 9$ b) $g(t) = 5t^3$ c) $h(x) = x^2 - 4x + 7$

3. Evaluate each of the following.
Given: $f(x) = 2x + 9$, $g(t) = 5t^3$, $h(x) = x^2 - 4x - 7$, $j(x) = x^4$
   a) Find $f(0.5)$ b) Find $g(-3)$ c) Find $h(0)$ d) Find $j(\sqrt{3})$ e) Find $j(m)$

   f) Find $t,\ if\ g(t) = 40$ g) Find $x,\ if\ f(x) = 0$ h) Find $g\left(\frac{x}{4}\right)$ i) Find $h(x-2)$

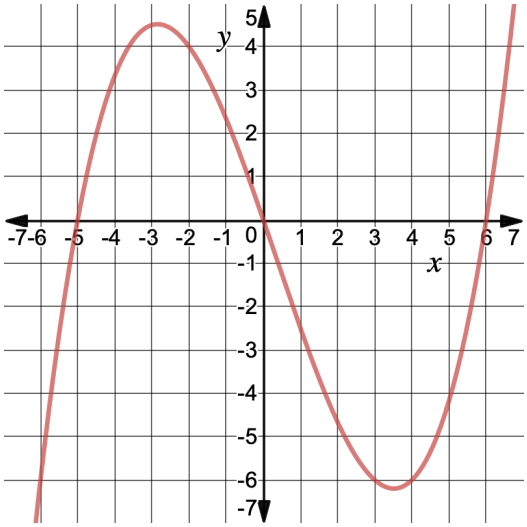
   j) $f(4) - h(3)$ k) Find $j(-2a)$

   l) Find $x\ if\ h(x) = f(x)$ NOTE: You will learn to do questions like this, later this unit.

   [CHALLENGE: Find $f(j(x))$ This Challenge is optional – you will do these in grade 12!]

4. Write ordered pairs that represent each of the following.
   a) $k(2) = -7$ b) $g(-5) = 4$ c) $f(1) = -1$ d) $k(0) = 50$

5. Given this graph of $f(x)$,



Find:

a) $f(-2)$ b) $f(0)$ c) $f(5)$

d) $x\ when\ f(x) = -6$ e) $x\ when\ f(x) = 0$

Answers:
1. a) $f(x) = 5x - 3$ b) $C(n) = 45n - 200$ c) $W(h) = 15h$ d) $A(r) = 4\pi r^2 - 12r + 2$
2. a) $y = 2x + 9$ b) $y = 5t^3$ c) $h = x^2 - 4x + 7$
3. a) $f(0.5) = 10$ b) $g(-3) = -135$ c) $h(0) = -7$ d) $j(\sqrt{3}) = 9$.....e) $j(m) = m^4$
   f) $t = 2$ g) $x = \frac{-9}{2}$ h) $g\left(\frac{x}{4}\right) = \frac{5x^3}{64}$ i) $h(x-2) = x^2 - 8x + 5$ j) $f(4) - h(3) = 27$
   k) $j(-2a) = 16a^4$ l) $x = -2\ or\ x = 8$ Challenge: $f(j(x)) = 2x^4 + 9$
4. a) $(2, -7)$ b) $(-5,4)$ c) $(1, -1)$ d) $(0,50)$
5. a) a) $f(-2) = 4$ b) $f(0) = 0$ c) $f(5) = -4$ d) $x = -6, 3, or\ 4$ e) $x = -5, 0, or\ 6$

U2D3 MCR 3UI Worksheet **Quadratic Functions**

1. The height of a rocket above the ground is modelled by the quadratic function $h(t) = -4t^2 + 32t$, where $h(t)$ is the height in metres t seconds after the rocket was launched.
   a) How long will the rocket be in the air? How do you know?
   b) How high will the rocket be after 3 seconds?
   c) What is the maximum height that the rocket will reach?

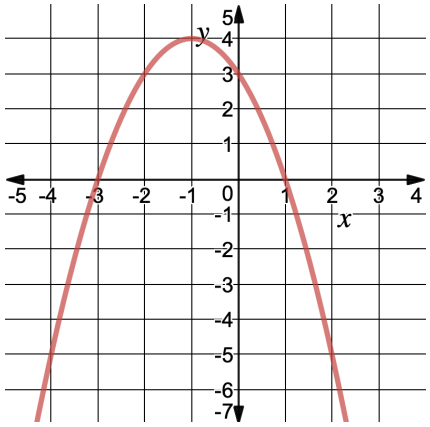
2. State whether each parabola opens up or down.
   a) $f(x) = 3x^2$ b) $f(x) = -2(x-3)(x+6)$ c) $f(x) = -(x+5)^2 - 1$ d) $f(x) = \frac{2}{3}x^2 - 2x - 1$

3. Given $f(x) = -3(x-2)(x+6)$, state:
   a) the zeros b) the direction of opening c) the equation of the axis of symmetry

4. Examine the parabola shown at the right.
   a) Copy and complete this table.

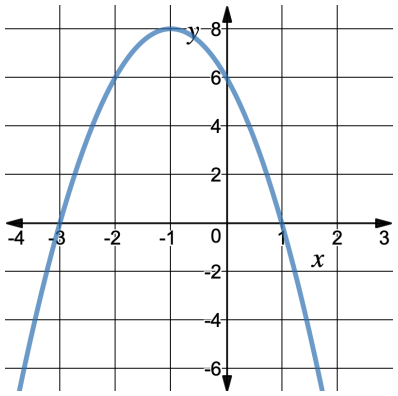
x	-2	-1	0	1	2
$f(x)$					

   b) Calculate the second differences of the function. How could you have predicted their signs?

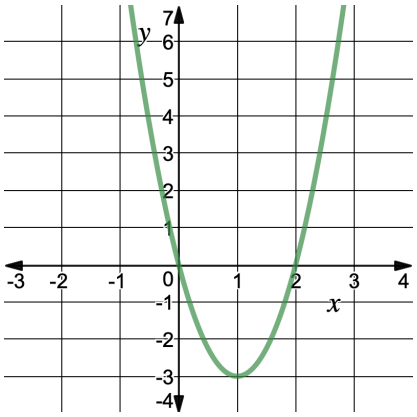


5. For each function, state the direction of opening, the vertex, and the equation of the axis of symmetry.
   a) $f(x) = x^2 - 3$ b) $f(x) = -(x+3)^2 - 4$
   c) $f(x) = 2(x-4)(x+2)$
   d) $f(x) = -\frac{1}{2}x^2 + 4$

6. Express each quadratic function in standard form. State the y-intercept of each.
   a) $f(x) = -3(x-1)^2 + 6$ b) $f(x) = 4(x-3)(x+7)$



7. Examine the parabola at the left.
a) State the direction of opening.
b) Name the coordinates of the vertex.
c) List the values of the *x*-intercepts.
d) State the Domain & Range
e) If you calculated the second differences, what would their sign be? How do you know?
f) Determine the algebraic model for this quadratic function.



8. Examine the parabola at the right.
a) State the direction of opening.
b) Name the coordinates of the vertex.
c) What is the equation of the axis of symmetry?
d) State the Domain & Range of the function.
e) If you calculated the second differences, what would their sign be? Explain.

9. Each pair of points (x, y) are the same distance from the vertex of their parabola. Determine the equation of the axis of symmetry of each parabola.
   a) (-2, 2), (2, 2) b) (-9, 1), (-5, 1)
   c) (6, 3), (18, 3)

Answers:

1. a) 8 seconds since $h(8) = 0$ b) $60\ m$ ..... c) $64\ m$
2. a) $a > 0$ so opens up b) $a < 0$ so opens down c) $a < 0$ so opens down d) $a > 0$ so opens up
3. a) zeros: $x = -6, x = 2$ b) $a < 0$ so opens down c) $x = -2$
4. a)

x	-2	-1	0	1	2
$f(x)$	3	4	3	0	-5
Δy	1	-1	-3	-5	
Second Differences	-2	-2	-2		

b) $2a = -2$ so $a = -1$
Parabola opens down so second differences are negative.

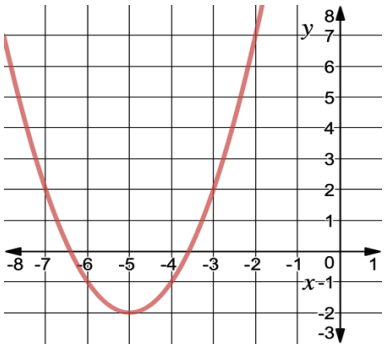
5.

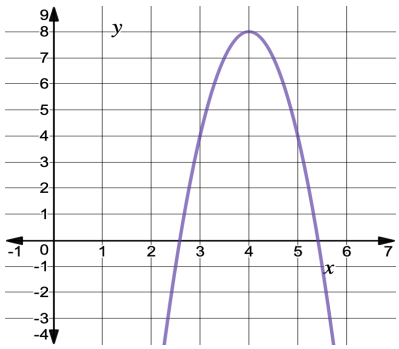
Function	Direction of Opening	Vertex	Axis of Symmetry
$f(x) = x^2 - 3$	Up	$(0, -3)$	$x = 0$
$f(x) = -(x+3)^2 - 4$	Down	$(-3, -4)$	$x = -3$
$f(x) = 2(x-4)(x+2)$	Up	$(1,18)$	$x = 1$
$f(x) = -\frac{1}{2}x^2 + 4$	Down	$(0,4)$	$x = 0$

6. a) $f(x) = -3x^2 + 6x + 3$ $y - intercept\ 3$ b) $f(x) = 4x^2 + 16x - 84$ $y - intercept - 84$
7. a) down b) $V(-1,8)$ c) $(-3,0), (1,0)$ d) $D: \{x \in \mathbb{R}\}$ $R: \{y \in \mathbb{R}, y \leq 8\}$
   e) negative (opens down) f) $f(x) = -2(x+1)^2 + 8$
8. a) up b) $V(1, -3)$ c) $x = 1$ d) $D: \{x \in \mathbb{R}\}$ $R: \{y \in \mathbb{R}, y \geq -3\}$
   e) positive since parabola opens up
9. a) $x = 0$ b) $x = -7$ c) $x = 12$

U2D4 MCR 3UI Worksheet **Maximums & Minimums**

1. Which of the following quadratic functions will have a maximum value? Explain how you know.
   a) $y = -x^2 + 7x$ b) $f(x) = 3(x-1)^2 - 4$ c) $f(x) = -4(x+2)(x-3)$ d) $g(x) = 4x^2 + 3x - 5$

2. State the vertex of each parabola and indicate the maximum or minimum value of the function.
   a)


   b)


3. Determine the maximum or minimum value for each.
   a) $y = -4(x+1)^2 + 6$ b) $f(x) = (x-5)^2$ c) $f(x) = -2x(x-4)$ d) $g(x) = 2x^2 - 7$

4. Determine the maximum or minimum value. Use at least two different methods.
   a) $y = x^2 - 4x - 1$ b) $f(x) = x^2 - 8x + 12$ c) $y = 2x^2 + 12x$
   d) $y = -3x^2 - 12x + 15$ e) $y = 3x(x-2) + 5$ f) $g(x) = -2(x+1)^2 - 5$

5. The height of a ball thrown vertically upward from a rooftop is modelled by $h(t) = -5t^2 + 20t + 50$, where $h(t)$ is the ball's height above the ground, in metres, at time t seconds after the throw.
   a) Determine the maximum height of the ball.
   b) How long does it take for the ball to reach its maximum height? c) How high is the rooftop?

6. Determine by **factoring** the maximum or minimum value of each of the following and state the value of x for which it occurs.
   a) $y = x^2 + 3x - 108$ b) $f(x) = -4x^2 + 12x - 9$ c) $y = -x^2 + 11x$
   d) $g(x) = 4x^2 + 4x - 15$ e) $f(x) = 6t^2 + 33t + 15$ f) $h(x) = -2x^2 - x + 15$

7. Determine by **partial factoring** the maximum or minimum value of each of the following and state the value of x for which it occurs.
   a) $g(x) = x^2 - 4x - 1$ b) $y = -2x^2 - 4x - 3$ c) $y = -3x^2 + 9x + 7$
   d) $g(x) = 4x^2 + 20x - 1$ e) $y = 5x^2 + 35t + 11$ f) $h(x) = -2x^2 + 22x - 15$

8. Determine by **completing the square (CTS)** the maximum or minimum value of each of the following and state the value of x (or t) for which it occurs.
   a) $v(t) = 2t^2 + 4t + 3$ b) $y = 8x - 2x^2$ c) $a(t) = -4t^2 - 24t + 29$
   d) $y = 5x^2 - 20x + 18$ e) $h(t) = -3t^2 + 18t + 28$ f) $y = 10x^2 + 20x + 12$

9. The path of the ball for many golf shots can be modeled by a quadratic function. The path of a golf ball hit at an angle of 10° to the horizontal can be modeled by the function $h(d) = -0.002d^2 + 0.4d$, where $h(d)$ is the ball's height above the ground, in metres, at horizontal distance, d metres from the golfer.
   a) Determine the maximum height reached by the ball.
   b) What is the horizontal distance of the ball from the golfer when the ball reaches its maximum height?
   c) What distance does the ball travel horizontally until it first hits the ground? Hint: Use symmetry with answer from part (b)

10. A hockey arena manager in Flin Flon determined that the formula for the dollar revenue $R(n)$, where n is the number of dollars increase over \$5 per ticket is $R(n) = -100n^2 + 500n + 5000$. What is the greatest revenue and at what price per ticket does the maximum occur?

11. A grappling iron is thrown vertically to catch a ledge above the thrower. If its height, $h(t)$, in metres, at t seconds after being thrown is represented by the function $h(t) = -4.9t^2 + 11t + 1.5$. a) Determine the maximum height of the grappling hook. b) Will the grappling hook reach a ledge 7.5 m above the thrower?

U2D4 Worksheet Answers:

1. Negative 'a' values mean maximum -- so only a, & c have maximums.
2. a) $V(-5,-2)$; Min value of -2 b) $V(4,8)$; Max value of 8
3. a) max value of 6 b) min value of 0 c) max value of 8 d) min value of -7
4. a) min -5 b) min -4 c) min -18 d) max 27 e) min 2 f) max -5
5. a) 70 m b) 2 seconds c) 50 m
6. a) $min\ of\ \frac{-441}{4}\ at\ x = \frac{-3}{2}$ b) $max\ of\ 0\ at\ x = \frac{3}{2}$ c) $max\ of\ \frac{121}{4}\ at\ x = \frac{11}{2}$
   d) $min\ of\ -16\ at\ x = \frac{-1}{2}$ e) $min\ of\ \frac{-243}{8}\ at\ x = \frac{-11}{4}$ f) $max\ of\ \frac{121}{16}\ at\ x = \frac{1}{4}$
7. a) $min\ of\ -5\ at\ x = 2$ b) $max\ of\ -1\ at\ x = -1$ c) $max\ of\ \frac{55}{4}\ at\ x = \frac{3}{2}$
   d) $min\ of\ -26\ at\ x = \frac{-5}{2}$ e) $min\ of\ \frac{-201}{4}\ at\ x = \frac{-7}{2}$ f) $max\ of\ \frac{91}{2}\ at\ x = \frac{11}{2}$
8. a) $min\ of\ 1\ at\ t = -1$ b) $max\ of\ 8\ at\ x = 2$ c) $max\ of\ 65\ at\ t = -3$
   d) $min\ of\ -2\ at\ x = 2$ e) $max\ of\ 55\ at\ t = 3$ f) $min\ of\ 2\ at\ x = -1$
9. a) 20 m b) 100 m c) 200 m
10. $The\ maximum\ Revenue\ of\ \$5625\ occurs\ with\ a\ ticket\ price\ is\ \$7.50.$ 11. a) $\frac{376}{49}\,m$ b) Yes.

U2D5 MCR3UI Worksheet Solving Quadratic Equations

1. Determine the roots of each equation by factoring.

a) $x^2 + 5x + 4 = 0$ b) $4x^2 - 9 = 0$ c) $x^2 - 11x + 18 = 0$ d) $2x^2 - 7x - 4 = 0$

2. Use the quadratic formula to determine each of the roots to two decimal places.

a) $x^2 - 4x - 9 = 0$ b) $3x^2 + 2x - 8 = 0$ c) $-2x^2 + 3x - 6 = 0$ d) $0.5x^2 - 2.2x - 4.7 = 0$

3. i) For each equation, decide on a strategy to solve it and explain why you chose that strategy.
ii) Use your strategy to solve the equation. When appropriate, leave your answer in simplest radical form.

a) $2x^2 - 3x = x^2 + 7x$ b) $4x^2 + 6x + 1 = 0$ c) $x^2 + 4x - 3 = 0$
d) $(x + 3)^2 = -2x$ e) $3x^2 - 5x = 2x^2 + 4x + 10$ f) $2(x + 3)(x - 4) = 6x + 6$

4. Locate the x −intercepts of the graph of each function.

a) $f(x) = 3x^2 - 7x - 2$ b) $f(x) = -4x^2 + 25x - 21$

5. The flight of a ball hit from a tree that is 0.6 m tall can be modelled by the function $h(t) = -4.9t^2 + 6t + 0.6$, where $h(t)$ is the height in metres at time t seconds. How long will it take for the ball to hit the ground?

6. Determine the break-even quantities for each profit function, where x is the number sold, in thousands.

a) $P(x) = -x^2 + 12x + 28$ b) $P(x) = -2x^2 + 18x - 40$
c) $P(x) = -2x^2 + 22x - 17$ d) $P(x) = -0.5x^2 + 6x - 5$

7. A rectangular swimming pool measuring **10 m by 4 m** is surrounded by a deck of uniform width. The **combined area** of the deck and the pool is **135 m²**. What is the **width** of the deck?

8. The sum of the squares of two consecutive integers is 685. What could the integers be? (list all possibilities)

9. Sally is standing on the top of a river slope and throws a ball. The height of the ball at a given time is modeled by the function $\boldsymbol{h(t) = -5t^2 + 30t + 10}$, where $h(t)$ is the height in metres and t is the time in seconds.

a) How long is the ball in the air, to the nearest tenth of a second? b) How high is the ball after 4 seconds?
c) When will the ball be 10m above the ground? d) What is the maximum height of the ball?

10. The height, $h(t)$, in metres, of an object fired upwards from the ground at 50 m/s is given approximately by the equation $h(t) = -5t^2 + 50t$ where t seconds is the time since the object was launched.

a) Does an object fired upwards at 50 m/s reach a height of 150 m? If so, after how many seconds is the object at this height?
b) When will the object hit the ground? c) When does it reach its maximum height?

11. The population of an Ontario city is modeled by the function $P(t) = 0.5t^2 + 10t + 300$ where P(t) is the population in thousands and t is the time in years. (Note: t = 0 corresponds to the year 2000)

a) What was the population in 2000? b) What will be the population in 2012?
c) When is the population expected to be 1,050,000?

12. The profit of a skateboard company can be modeled by the function $P(x) = -63 + 133x - 14x^2$, where $P(x)$ is the profit in thousands of dollars and x is the number of skateboards sold, also in thousands.

a) What is the maximum profit the company can earn?
b) Determine when the company is profitable by calculating the break-even points.

13. In Vancouver, the height, h, in kilometres, that you would need to climb to see to the east coast of Canada can be modelled by the equation $h^2 + 12\,740h = 20\,000\,000$. If the positive root of this equation is the solution, find the height, to the nearest kilometre.

ANSWERS:

1. a) $\{-4, -1\}$ b) $\{2, 9\}$ c) $\left\{\frac{-3}{2}, \frac{3}{2}\right\}$ d) $\left\{\frac{-1}{2}, 4\right\}$ 2. a) $\{-1.61, 5.61\}$ b) $\left\{-2, \frac{4}{3}\right\}$ c) { } -- means there is no solution d) $\{-1.57, 5.97\}$

3.

Easiest method	Roots		Easiest Method	Roots
a) Common Factoring	$\{0, 10\}$		b) DNF -- Quadratic Formula	$\left\{\frac{-3 \pm \sqrt{5}}{4}\right\}$
c) DNF – use Quadratic Formula	$\{-2 \pm \sqrt{7}\}$		d) DNF – use Quad. Formula	$\{-4 \pm \sqrt{7}\}$
e) Simple Trinomial Factoring	$\{-1, 10\}$		f) DNF – use Quad. Formula	$\{2 \pm \sqrt{19}\}$

4. a) $\left\{\frac{7 \pm \sqrt{73}}{6}\right\}$ b) $\left\{1, \frac{21}{4}\right\}$ 5. $\frac{30 \pm \sqrt{1194}}{49}$ or about 1.32 seconds. 6. a) 14 000 units
6. b) 4000 *units or* 5000 *units* 6. c) 836 *units or* 10 164 *units*
6.d) 901 *units or* 11 099 *units* 7. 2.5 m 8. $-19, -18$ *OR* $18, 19$
9. a) 6.3 *seconds* b) 50 m c) 6.2 *sec.* d) 55 m
10. a) *no* b) 10 *sec.* c) 5 *sec.* 11. a) 300 000 b) 492 000 c) 2030
12. a) \$252 875 b) 500 *units or* 9000 *units* 13. 1413 km

U2D6 MCR 3UI **Worksheet Quadratic Applications**

1. A cliff diver dives from 17m above the water. The diver's height above the water, h(*t*) in metres after *t* seconds is modelled by $h(t) = -4.9t^2 + 1.5t + 17$. Determine when the diver was 5 m above the water.

2. The function $P(x) = -30x^2 + 360x + 785$ models the profit, P(*x*), earned by a theatre owner on the basis of a ticket price, *x*. Both the profit and ticket price are in dollars. What is the maximum profit and how much should the tickets cost?

3. The population of a town is modelled by the function $P(t) = 6t^2 + 110t + 4000$, where P(*t*) is the population and *t* is the time in years since 2000.
   a. What will the population be in 2020?
   b. When will the population be 6000?
   c. Will the population ever be 0? Explain your answer.

4. The profit of a shoe company is modelled by the function $P(x) = -5(x - 4)^2 + 45$, where x is the number of pairs of shoes produced in thousands, and P(x) is the profit, in thousands of dollars. How many thousands of pairs of shoes will the company need to sell to earn a profit?

5. Beth wants to plant a garden at the back of her house. She has 32m of fencing. The area that can be enclosed is modelled by the function $A(x) = -2x^2 + 32x$, where x is the width of the garden in metres and A(x) is the area in square metres. What is the maximum area that can be enclosed?

6. A rectangle is 7 cm longer than it is wide. The diagonal is 13cm. What are the rectangle's dimensions?

7. A photo framer wants to place a matte of uniform width all around a photo. The area of the matte should be equal to the area of the photo. The photo measures 40 cm by 60cm. How wide should the matte be?

8. The stopping distance for a boat in calm water is modelled by the function $d(v) = 0.004v^2 + 0.2v + 6$, where d(v) is in metres and v is in kilometres per hour.
   a. What is the stopping distance if the speed is 10km/h?
   b. What is the initial speed of the boat if it takes 11.6m to stop?

9. Mario wants to install a wooden deck around his rectangular swimming pool. The cost is modelled by the function $C(w) = 120w^2 + 1800w$, where C(w) is the cost in dollars and w is the width in metres. How wide will the deck be if he has $4080 to spend?

10. The population of a rural town can be modelled by the function $P(x) = 3x^2 – 102x + 25000$, where x is the number of years since 2000. According to the model in what year will the population be lowest?

11. A bowling alley has a $5 cover charge on Friday nights. The manager is considering increasing the cover charge in 50¢ increments. The revenue modelled by the function $R(x) = -12.5x^2 + 75x + 2000$, where revenue R(x) is in dollars and x is the number of 50¢ increments.
   a. What cover charge will maximize revenue?
   b. What will the cover charge be if revenue is $2000?

12. The height of a soccer ball kicked in the air is given by the equation $h(t) = -4.9(t - 2.1)^2 + 23$, where t, is the time in seconds and h(t) is the height in metres
   a. What is the height of the ball when it was kicked?
   b. What is the maximum height of the ball?
   c. Is the ball still in the air after 6 seconds? Explain
   d. For how long was the ball <u>at least</u> 10m high?

Answers

1. 1.73 s **2.** $1865 & $6 **3.** a.)8600 b)2011 c)no **4.** between 1000 & 7000
5. $128m^2$ **6.** 5 cm X 12 cm **7.** 10 cm **8.** a)8.4km b) 20km/h
9. 2 m **10.** 2017 **11.** a)$6.50 b) $5 or $8
12. a)1.39m b)23m c)no hits ground at 4.3s d) 3.26s

Unit 2: Quiz Part A: REVIEW Radicals – no Calculator!

1. Simplify the following:

a) $\sqrt{50}$ b) $\sqrt{7} - 3\sqrt{7}$ c) $5\sqrt{3} - 4\sqrt{72} + \sqrt{150} + 2\sqrt{8}$

d) $5\sqrt{3}(4 + 5\sqrt{3} - 2\sqrt{15})$ e) $(\sqrt{2} + 5)(2 - \sqrt{2})$ f) $\frac{4 \pm \sqrt{28}}{2}$

Unit 2: Quiz Part B: REVIEW Quadratics -- Calculator Allowed!

1. Determine the maximum or minimum value of the function $q(x) = -2x^2 - 3x + 5$ and state the $x-$ value for which this occurs, USING ALL THREE METHODS (Factoring, Partial Factoring, Completing the Square). State the domain and range of the Parabola.

2. Given $p(x) = 3x - 7$ a) Calculate the value of $p(2)$. b) If $p(x) = -9$, calculate the value of x.

3. For each of the following, determine whether the relation is a function or not. Be prepared to justify your answer.

a) $3x^2 + y^2 = 9$ b) $x = -3$ c) $y = 0$ d) $3x^2 - 6y = 9$ e) $3x - 5y = 14$

U2D8 MCR3UI WORKSHEET **Inequalities**

Part A Linear Inequalities

1. **Solve the following linear inequalities.**

Question		Answer
a)	$3x+6>-3$	$x>-3$
b)	$7x\geq 2x+10$	$x\geq 2$
c)	$3(x-5)\leq 5x-9$	$x\geq -3$
d)	$3(y-5)\leq 9(y+1)-2y$	$y\geq -6$
e)	$\frac{x-2}{3}\leq 2x-3$	$x\geq \frac{7}{5}$

Part B Quadratic Inequalities

Solve the following quadratic inequalities.

a)	$x^2-1>0$	$x>1$ *or* $x<-1$
b)	$x^2-x-12<0$	$-3<x<4$
c)	$(2x-3)(x+4)\geq 0$	$x\geq \frac{3}{2}$ *or* $x\leq -4$
d)	$-3x(x-5)\leq 0$	$x\leq 0$ *or* $x\geq 5$
e)	$k^2-9k\geq 0$	$k\leq 0$ *or* $k\geq 9$

Extra Practice Questions:

1. Solve the following inequalities and graph the solution on the real number line:

a) $6-2x>4$

b) $4(1-x)\geq 3(x-1)$

c) $2(3x-1)-5x>-6(1-x)+7$

d) $\frac{2x}{3}+1\geq 2$

e) $\frac{x+1}{2}<\frac{x+2}{3}$

f) $\frac{2-3x}{2}+\frac{2}{3}\leq\frac{3x-2}{6}$

2. Solve the following inequalities and graph the solution on the real number line:

a) $4x^2+8x+3>0$

b) $10x^2-17x+3\leq 0$

c) $2x^2+11x+15<0$

d) $8x^2-10x-12\geq 0$

e) $-6x^2-15x-9>0$

f) $12x^2-11x+2<0$

g) $-4x^2+18x+10\leq 0$

ANSWERS

1a) $x<1$ **b)** $x\leq 1$ **c)** $x<\frac{-3}{5}$

d) $x\geq\frac{3}{2}$ **e)** $x<1$ **f)** $x\geq 1$

2a) $\left\{x<-\frac{3}{2}\right\}\cup\left\{x>-\frac{1}{2}\right\}$ **b)** $\left\{\frac{1}{5}\leq x\leq\frac{3}{2}\right\}$ **c)** $\left\{-3<x<-\frac{5}{2}\right\}$

d) $\left\{x\leq-\frac{3}{4}\right\}\cup\{x\geq 2\}$ **e)** $\left\{-\frac{3}{2}<x<-1\right\}$ **f)** $\left\{\frac{1}{4}<x<\frac{2}{3}\right\}$

g) $\left\{x\leq-\frac{1}{2}\right\}\cup\{x\geq 5\}$

U2D9 MCR3UI Worksheet **Zeros & The Discriminant**

1. Determine the vertex and the direction of opening for each quadratic function. Then state the number of zeros.
a) $f(x) = 3x^2 - 5$ b) $f(x) = -4x^2 + 7$ c) $f(x) = 5(x+2)^2$ d) $f(x) = 0.5(x-4)^2 - 2$
2. Factor each quadratic to determine the number of zeros.
a) $f(x) = x^2 - 6x - 16$ b) $f(x) = 2x^2 - 6x$ c) $f(x) = 4x^2 - 1$ d) $f(x) = 9x^2 + 6x + 1$
3. Calculate the value of $b^2 - 4ac$ to determine the number of zeros.
a) $f(x) = 2x^2 - 6x - 7$ b) $f(x) = 3x^2 + 2x + 7$ c) $f(x) = x^2 + 8x + 16$ d) $f(x) = 9x^2 - 14.4x + 5.76$
4. Determine the number of zeros.
a) $f(x) = -3(x-2)^2 + 4$ b) $f(x) = 5(x-3)(x+4)$ c) $f(x) = 4x^2 - 2x$ d) $f(x) = 3x^2 - x + 5$
5. For each profit function, determine whether the company can break even. If the company can break even. If the company can break even, determine in how many ways it can do so.
a) $P(x) = -2.1x^2 + 9.06x - 5.4$ b) $P(x) = -0.3x^2 + 2x - 7.8$
c) $P(x) = -2x^2 + 6.4x - 5.12$ d) $P(x) = -2.4x^2 + x - 1.2$
6. For what value(s) of k will the function $f(x) = 3x^2 - 4x + k$ have one x-intercept?
7. For what value(s) of k will the function $f(x) = kx^2 - 4x + k$ have no zeros?
8. For what value(s) of k will the function $f(x) = 3x^2 + 4x + k$ have no zeros? one zero? two zeros?
9. The graph of the function $f(x) = x^2 - kx + k + 8$ touches the x-axis at one point.
What are the possible values of k?
10. Determine the nature of the roots for each equation.
a) $4x^2 + 7x - 2 = 0$ b) $2x^2 - 7x - 15 = 0$ c) $3x^2 - 8x + 7 = 0$
d) $7x^2 + 10x - 3 = 0$ e) $16x^2 + 8x + 1 = 0$ f) $12x^2 - 9x + 5 = 0$

11 & 12 extra practice

11. Solve the following for $x \in \mathbb{R}$
a) $5x^2 + 4x - 1 = 0$ b) $2x^2 - 8x + 5 = 0$ c) $5x(x+3) = (3x+2)(x-1)$
d) $(2x+5)(x-3) = (4x+7)(3x-1)$ e) $(x+2)(5x+1) = 5x - 2(2x+1)(x+1)$
f) $(2x+7)(x+4) = (3x+5)(x-2)$
12. Solve the following for $x \in \mathbb{R}$
a) $\frac{x^2+5}{3} - \frac{7}{2} = \frac{x+8}{2}$ b) $\frac{8}{x} + \frac{5}{x+2} = 1$ c) $\frac{3}{2x+1} - \frac{x+2}{3x-1} = \frac{x-3}{2x+1}$ d) $\sqrt{3x+1} = x - 3$ e) $\sqrt{2x^2-2} - x = 1$
13. For what value(s) of k does each equation have two *equal real roots*?
a) $3x^2 - kx + 8 = 0$ b) $5x^2 + 8x - 2k = 0$ c) $kx^2 + 9 = 18x$ d) $(3k+1)x^2 + kx + 1 = 0$
14. For what value(s) of m does each equation have two *distinct real roots*?
a) $2x^2 + mx + 8 = 0$ b) $5mx^2 + 6x + 2 = 0$ c) $3(x^2 - 2m) = 9x$ d) $4x^2 - 2mx + 3 = 0$
15. Using the Discriminant, determine the following.
a) For what values of k does $5kx^2 + 6x + 2 = 0$ have 2 real roots?
b) For what values of k does $2x^2 + kx + 9 = 0$ have no real roots?
c) For what values of k does $4x^2 - 2kx + 3 = 0$ have 2 real roots?

Answers:

1. a) V(0,-5); up; 2 b) V(0, 7); down; 2 c) V(-2, 0); up; 1 d) V(4, -2); up; 2
2. a) $(x-8)(x+2)$; 2 b) $(2x)(x-3)$; 2 c) $(2x+1)(2x-1)$; 2 d) $(3x+1)^2$; 1
3. a) $D = 92$; 2 b) $D = -80$; 0 c) $D = 0$; 1 d) $D = 0$; 1
4. a) 2 b) 2 c) 2 d) 0
5. a) yes, 2 ways b) cannot break even c) yes, one way d) cannot break even
6. $\left\{k = \frac{4}{3}\right\}$
7. $\{k < -2 \text{ or } k > 2\}$
8. No zeros -- $\left\{k > \frac{4}{3}\right\}$ One zero -- $\left\{k = \frac{4}{3}\right\}$ Two zeros -- $\left\{k < \frac{4}{3}\right\}$
9. $k \in \{-4, 8\}$
10. a) 2 real & distinct b) 2 real & distinct c) no real roots d) 2 real & distinct e) one root (real & equal) f) no real roots
11. a) $x \in \{-1, \frac{1}{5}\}$ b) $x \in \left\{\frac{4 \pm \sqrt{6}}{2}\right\}$ c) $x \in \{-4 \pm \sqrt{15}\}$ d) $x \in \{-1, -\frac{4}{5}\}$ e) $x \in \left\{-\frac{2}{3}\right\}$ f) $x \in \{8 \pm \sqrt{102}\}$
12. a) $x \in \{-\frac{7}{2}, 5\}$ b) $x \in \left\{\frac{11 \pm \sqrt{185}}{2}\right\}$ c) $x \in \left\{\frac{4}{5}, 2\right\}$ d) $x \in \{1, 8\}$ e) $x \in \{-1, 3\}$
13. a) $k \in \{\pm 4\sqrt{6}\}$ b) $k \in \left\{-\frac{8}{5}\right\}$ c) $k \in \{9\}$ d) $k \in \{6 \pm 2\sqrt{10}\}$
14. a) $\{m < -8 \text{ or } m > 8\}$ b) $\left\{m < \frac{9}{10}\right\}$ c) $\left\{m > -\frac{9}{8}\right\}$ d) $\{m < -2\sqrt{3} \text{ or } m > 2\sqrt{3}\}$
15. a) $\left\{k < \frac{9}{10}\right\}$ b) $\{-6\sqrt{2} < k < 6\sqrt{2}\}$ c) $\{k > 2\sqrt{3} \text{ or } k < -2\sqrt{3}\}$

U2D10 MCR3UI Worksheet <u>Systems of Equations Involving Quadratics</u>

1. Determine the point(s) of intersection algebraically.
   a) $f(x) = -x^2 + 6x - 5,\ g(x) = -4x + 19$ b) $f(x) = 2x^2 - 1,\ g(x) = 3x + 1$
   c) $f(x) = 3x^2 - 2x - 1,\ g(x) = -x - 6$
2. Determine the number of points of intersection of $f(x) = 4x^2 + x - 3$ and $g(x) = 5x - 4$ without solving.
3. Determine the point(s) of intersection of each pair of functions.
   a) $f(x) = -2x^2 - 5x + 20,\ g(x) = 6x - 1$ b) $f(x) = 3x^2 - 2,\ g(x) = x + 7$
   c) $f(x) = 5x^2 + x - 2,\ g(x) = -3x - 6$
4. The revenue function for a production by a theatre group is $R(t) = -50t^2 + 300t$, where t is the ticket price in dollars. The cost function for the production is $C(t) = 600 - 50t$. Determine the ticket price that will allow the production to break even.
5. Determine the value of k such that $g(x) = 3x + k$ intersects the quadratic function $f(x) = 2x^2 - 5x + 3$ at exactly one point.
6. Determine the value(s) of k such that the linear function $g(x) = 4x + k$ does not intersect the parabola $f(x) = -3x^2 - x + 4$.
7. Determine through investigation, the equations of lines that have a slope of 2 and intersect the quadratic function $f(x) = x(x - 6)$
   a) Once b) Twice c) Never
8. Solve algebraically. You may confirm graphically.
   a) $y = 3 - x;\ y = x^2 - 8x + 13$ b) $g(x) = 4x - 1;\ f(x) = -2x^2 + 4x + 1$
   c) $12x - 4y = 19;\ y = 3x^2 - 12x + 14$ d) $2x - 3y = -6;\ y = -3x^2 + 24x - 50$
   e) $h(x) = 2x^2 + 3;\ g(x) = x^2 - 2x + 7$ f) $h(x) = -2x^2 + 24x - 69;\ g(x) = x^2 - 10x + 27$
9. An asteroid is moving in a parabolic arc that is modelled by the function $y = -6x^2 - 370x + 100\,900$. For the period of time that it is in the same area, a space probe is moving along a straight path on the same plane as the asteroid according to the linear equation $y = 500x - 83\,024$. A space agency needs to determine if the asteroid will be an issue for the space probe. Will the two paths intersect?
10. The UV index on a sunny day can be modelled by the function $f(x) = -0.15(x - 13)^2 + 7.6$ where x represents the time of day on a 24-hour clock and $f(x)$ represents the UV index. Between what hours was the UV index greater than 7?
11. A parachutist jumps from an airplane and immediately opens his parachute. His altitude, y, in metres, after t seconds is modelled by the equation $y = -4t + 300$. A second parachutist jumps 5 s later and freefalls for a few seconds. Her altitude, in metres, during this time, is modelled by the equation $y = -4.9(t - 5)^2 + 300$.
    When does she catch up to the first parachutist?

<u>Answers</u>:

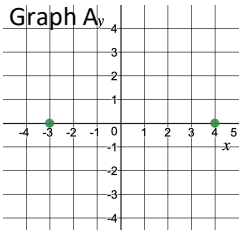
1. a) $\{(4,3), (6,-5)\}$ b) $\left\{(2,7), \left(-\frac{1}{2}, -\frac{1}{2}\right)\right\}$ c) no intersection
2. one
3. a) $\left\{\left(\frac{3}{2}, 8\right), (-7, -43)\right\}$ b) $\left\{\left(\frac{1+\sqrt{109}}{6}, \frac{43+\sqrt{109}}{6}\right), \left(\frac{1-\sqrt{109}}{6}, \frac{43-\sqrt{109}}{6}\right)\right\}$
   c) no intersection
4. \$3 or \$4 5. $k = -5$ 6. $k > \frac{73}{12}$
7. a) $y = 2x - 16$ b) $y = 2x + b, b > -16$ c) $y = 2x + b, b < -16$
8. a) $\{(2,1), (5,-2)\}$ b) $\{(1,3), (-1,-5)\}$ c) $\left\{\left(\frac{5}{2}, \frac{11}{4}\right)\right\}$ d) no real solution
   e) $\left\{\left(-1+\sqrt{5}, 15-4\sqrt{5}\right), \left(-1-\sqrt{5}, 15+4\sqrt{5}\right)\right\}$ f) $\left\{(6,3), \left(\frac{16}{3}, \frac{19}{9}\right)\right\}$
9. $D > 0$ *so they will intersect.* 10. From 11:00 a.m. until 3:00 p.m.
11. 7.5 seconds after the first parachutist jumps (2.5 seconds after she jumps)

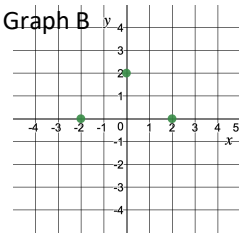
U2D11 MCR3UI Worksheet <u>Families of Quadratics</u>

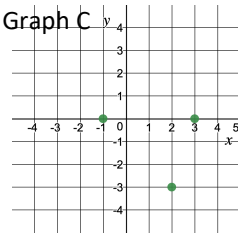
Determine the maximum number of parabolas that could be drawn through the points given in each of the graphs to the right.

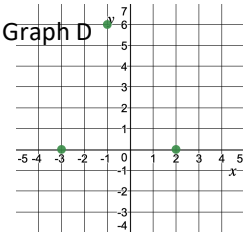
Number of Points:

Number of Possible Parabola:

Graph A 

Graph B 

Graph C 

Graph D 

What is the minimum number of points required to define a unique parabola?

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1. What characteristics will two parabolas in the family $f(x) = a(x-2)(x+5)$ share?
2. How are the parabolas $f(x) = -2(x-3)^2 - 5$ and $g(x) = 6(x-3)^2 - 5$ the same? How are they different?
3. What point do the parabolas $f(x) = 3x^2 + 5x - 9$ and $g(x) = -5x^2 + 5x - 9$ have in common?
4. Determine the equation of the parabola with x-intercepts
   a) -4 and 3, and that passes through (2, 7)
   b) 0 and 8, and that passes through (-3, -6)
   c) $\sqrt{7}\ and\ -\sqrt{7}$, and that passes through (-5, 3)
   d) $1-\sqrt{2}\ and\ 1+\sqrt{2}$, and that passes through (2, 4)
5. Determine the equation of the parabola with vertex
   a) (-2, 5) and that passes through (4, -8)
   b) (1, 6) and that passes through (0, -7)
   c) (4, -5) and that passes through (-1, -3)
   d) (4, 0) and that passes through (11, 8)
6. Determine the equation of the quadratic function $f(x) = ax^2 - 6x - 7$ if $f(2) = 3$
7. Determine the equation of the parabola with x-intercepts ± 4 and passing through (3, 6)
8. Determine the equation of the quadratic function that passes through (-4, 5) if its zeros are $2+\sqrt{3}$ and $2-\sqrt{3}$.
9. What is the equation of the parabola with zeros -1, -3 if the point (-4, -9) is on the graph?
10. a) Write the equation of the family of quadratic functions whose roots are 5 and -6.
    b) Determine the equation of the *specific member* of the above family that passes through the point (1, -3)
11. Write one possible quadratic equation, given each pair of roots:
    a) $7 \text{ and } -2$ b) $-\frac{3}{5}\ and\ -\frac{2}{3}$ c) $2-\sqrt{5}\ and\ 2+\sqrt{5}$ d) $\frac{3+2\sqrt{6}}{2}\ and\ \frac{3-2\sqrt{6}}{2}$
12. Determine the standard form equation of the quadratic function that has an optimal value of -12, if the roots of the corresponding quadratic equation are $3+2\sqrt{3}\ and\ 3-2\sqrt{3}$.
13. Determine the standard form equation of the quadratic function that goes through $(-4,-1)$, if the only root of the corresponding quadratic equation is $-\frac{7}{2}$.
14. Determine the standard form equation of the quadratic function that represents the family of parabolas, if the roots of the corresponding quadratic equation are $-\frac{\sqrt{5}}{2}\ \ and\ \ \frac{\sqrt{5}}{2}$.

<u>Answers</u>:

1. Same zeros, Same Axis of Symmetry
2. Same vertex, same A of S, different direction of opening, different stretch
3. $f(x), g(x)$ have the same y-intercept at -9

4. a) $y = \frac{-7}{6}(x+4)(x-3)$ 4. b) $y = \frac{-2}{11}(x)(x-8)$ 4. c) $y = \frac{-1}{6}(x^2-7)$ 4. d) $y = -4x^2+8x+4$
5. a) $y = \frac{-13}{36}(x+2)^2+5$ 5.b) $y = -13(x-1)^2+6$ 5.c) $y = \frac{2}{25}(x-4)^2-5$ 5. d) $y = \frac{8}{49}(x-4)^2$
6. $y = \frac{11}{2}x^2-6x-7$ 7. $y = \frac{-6}{7}(x^2-16)$ 8. $y = \frac{5}{33}(x^2-4x+1)$ 9. $y = -3x^2-12x-9$
10. a) $y = k(x-5)(x+6)$ 10. b) $y = \frac{3}{28}(x-5)(x+6)$
11. a) $x^2-5x-14=0$ 11. b) $15x^2+19x+6=0$ 11. c) $x^2-4x-1=0$ 11. d) $4x^2-12x-15=0$
12. $f(x) = x^2-6x-3$ 13. $f(x) = -4x^2-28x-49$ 14. $f(x) = 4kx^2-5k,\ k \in \mathbb{R}$

U2D12 MCR3UI Worksheet **Quadratics Review**

1. Consider the quadratic function $f(x) = -3(x-2)^2 + 5$.
   a) State the direction of opening, the vertex, and the axis of symmetry.
   b) State the domain and range.
   c) Graph the function.

2. Consider the quadratic function $f(x) = 4(x-2)(x+6)$.
   a) State the direction of opening, and the zeros of the function.
   b) Determine the coordinates of the vertex.
   b) State the domain and range.
   c) Graph the function.

3. Determine the equation of the axis of symmetry of the parabola with points $(-5,3)$ and $(3,3)$ equally distant from the vertex on either side of it.

4. For each quadratic function, state the maximum or minimum value and where it will occur.
   a) $f(x) = -3(x-4)^2 + 7$ b) $f(x) = 4x(x+6)$

5. The height, $h(t)$, in metres, of the trajectory of a football is given by $h(t) = 2 + 28t - \frac{49}{10}t^2$, where t is the time in flight, in seconds. Determine the maximum height of the football and the time when that height is reached. (Use fractions)

6. Express each number as a mixed radical in simplest form.
   a) $\sqrt{98}$ b) $-5\sqrt{32}$ c) $4\sqrt{12} - 3\sqrt{48}$ d) $\left(3 - 2\sqrt{7}\right)^2$

7. Determine the x-intercepts of the quadratic function $f(x) = 2x^2 + x - 15$.

8. The population of a Canadian city is modelled by $P(t) = 12t^2 + 800t + 40\,000$, where t is the time in years. When $t = 0$, the year is 2007.
   a) According to the model, what was the population expected to be in 2010?
   b) In what year is the population predicted to be 300 000?

9. The height, $h(t)$, of a projectile, in metres, can be modelled by the equation $h(t) = 14t - 5t^2$, where t is the time in seconds after the projectile is released. Can the projectile ever reach a height of 9 m? Explain.

10. Determine the values of k for which the function $f(x) = 4x^2 - 3x + 2kx + 1$ has two zeros. Check these values in the original equation.

11. Determine the break-even points of the profit function $P(x) = -2x^2 + 7x + 8$, where x is the number of dirt bikes produced, in thousands.

12. Determine the equation of the parabola with roots $2 + \sqrt{3}$ *and* $2 - \sqrt{3}$, and passing through the point $(2,5)$.

13. Describe the characteristics that the members of the family of parabolas $f(x) = a(x+3)^2 - 4$ have in common. Which member passes through the point $(-2, 6)$?

14. An engineer is designing a parabolic arch. The arch must be 15 m high, and 6 m wide at a height of 8 m.
   a) Determine a quadratic function that satisfies these conditions.
   b) What is the width of the arch at its base?

15. Calculate the point(s) of intersection of $f(x) = 2x^2 + 4x - 11$ and $g(x) = -3x + 4$

16. The height, $h(t)$, of a baseball, in metres, at time t seconds after it is tossed out of a window is modelled by the function $h(t) = -5t^2 + 20t + 15$. A boy shoots at the baseball with a paintball gun. The trajectory of the paintball is given by the function $g(t) = 3t + 3$. Will the paintball hit the baseball? If so, when? At what height will the baseball be?

U2D12 MCR3UI Worksheet **Quadratics Review**

17. a) Will the parabola defined by $f(x) = x^2 - 6x + 9$ intersect the line $g(x) = -3x - 5$? Justify your answer.
    b) Change the slope of the line so that it will intersect the parabola in two locations.

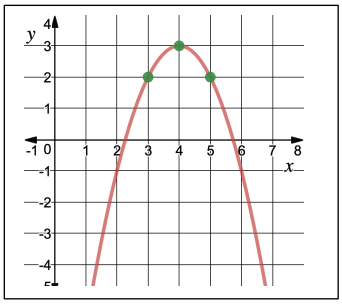
18. You are given $f(x) = -5x^2 + 10x - 5$.
    a) Express the function in factored form and determine the vertex.
    b) Identify the zeros, the axis of symmetry, and the direction of opening.
    c) State the domain and range.
    d) Graph the function.

19. For each function, state whether it will have a maximum or a minimum value. Describe the method you would choose to calculate the maximum or minimum value.
    a) $f(x) = -2x^2 - 8x + 3$ b) $f(x) = 3(x - 1)(x + 5)$

20. Calculate the value of k such that $kx^2 - 4x + k = 0$ has one root.

21. Does the linear function $g(x) = 6x - 5$ intersect the quadratic function $f(x) = 2x^2 - 3x + 2$? How can you tell? If it does intersect, determine the point(s) of intersection.

22. Determine the equation in standard form of the parabola shown to the right.



23. a) Simplify $(2 - \sqrt{8})(3 + \sqrt{2})$.
    b) Simplify $(3 + \sqrt{5})(5 - \sqrt{10})$.

ANSWERS:

1. a) down; $V(2,5)$; $x = 2$ b) $D: \{x | x \in \mathbb{R}\}$ c) $R: \{y | y \in \mathbb{R}, y \leq 5\}$
2. a) up; $x = 2, x = -6$ b) $V(-2,-64)$ c) $D: \{x | x \in \mathbb{R}\}$ $R: \{y | y \in \mathbb{R}, y \geq -64\}$
3. $x = -1$ 4. a) Maximum of 7 when $x = 4$ b) Minimum of -36 when $x = -3$
5. $42\ m$ after $\frac{20}{7}\ second$ 6. a) $7\sqrt{2}$ b) $-20\sqrt{2}$ c) $-4\sqrt{3}$ d) $37 - 12\sqrt{7}$
7. $x = \frac{5}{2}$, $x = -3$ 8. a) 52 428 b) 2124 9. Yes.
10. $\left\{k < -\frac{1}{2}\ or\ k > \frac{7}{2}\right\}$ 11. 4408 bikes 12. $y = \frac{-5}{3}x^2 + \frac{20}{3}x - \frac{5}{3}$
13. $V(-3,-4)$; $y = 10(x + 3)^2 - 4$ 14. a) $y = \frac{-7}{9}(x - 3)^2 + 15$ b) $8.783\ m$
15. $\left\{(-5,19), \left(\frac{3}{2}, \frac{-1}{2}\right)\right\}$ 16. Yes, at $15\ m$ after $4\ s$.
17. a) No. b) $\left\{m < \left(-6 - 2\sqrt{14}\right) or\ m > \left(-6 + 2\sqrt{14}\right)\right\}$
18. a) $f(x) = -5(x - 1)^2$; $V(1,0)$ b) $x = 1$; Down c) $D: \{x | x \in \mathbb{R}\}$ $R: \{y | y \in \mathbb{R}, y \leq 1\}$
19. a) Maximum (complete the square or partial factor) b) Minimum (use factored form)
20. a) $\{k = \pm 2\}$ 21. Yes; $D > 0$; $\left\{\left(\frac{7}{2}, 16\right), (1,1)\right\}$ 22. $y = -x^2 + 8x - 13$
23. a) $2 - 4\sqrt{2}$ b) $15 - 3\sqrt{10} + 5\sqrt{5} - 5\sqrt{2}$