MCF3M1 Mid Term Exam Review Name: _____

Date: _____

(1) 1. Circle the quadratic function.

a) $f(x) = 3x(5 - x)$ b) $3y = 12 + 4x$ c) $x + y = 25$

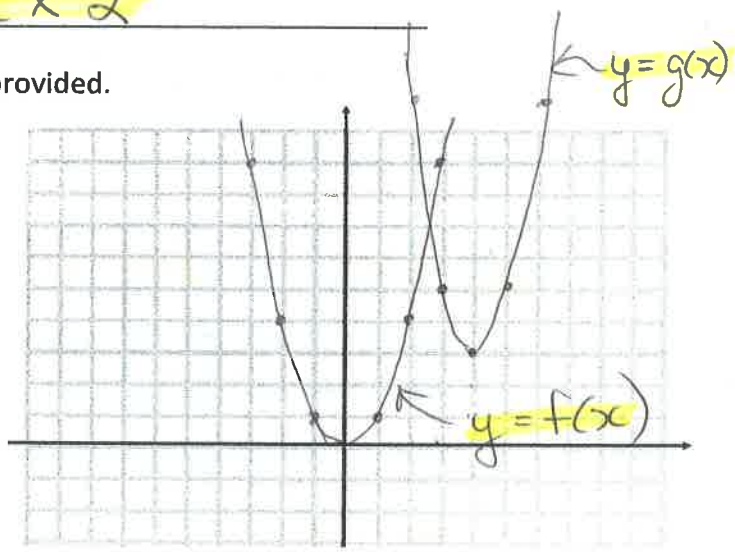
53

2. A function is defined by $g(x) = 2(x - 4)^2 + 3$.

(3) a) List the transformations to the graph $f(x) = x^2$ of to get **g(x)**.

1. shift right by 4
2. shift up by 3
3. vertical stretch x 2

(4) b) Graph and label both **g(x)** and **f(x)** on the grid provided.



(3) c) State the domain and range for g(x).

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

R = $\{y \mid y \in \mathbb{R}, y \geq 3\}$

(2) d) Calculate **g(2)**.

$g(2) = 2(2-4)^2 + 3$

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

$= 2(4) + 3$

$g(2) = 11$

3. Write the following in **Standard Form:**

(2) a) $f(x) = (2x - 3)(7x - 6)$

$= 14x^2 - 12x - 21x + 18$

$= 14x^2 - 33x + 18$

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

$= -2(x+3)(x+3) - 5$

$= -2(x^2 + 3x + 3x + 9) - 5$

$= -2(x^2 + 6x + 9) - 5$

$= -2x^2 - 12x - 18 - 5$

$= -2x^2 - 12x - 23$

4. **Factor and solve for the roots** of the equation. Use any method.

(2) a) $x^2 + 8x + 15 = 0$

15 → 3, 5

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

$x = -3$ $x = -5$

(2) b) $2x^2 + 20 = 14x$

10 → 5, 2

$2x^2 - 14x + 20 = 0$

$2(x^2 - 7x + 10) = 0$

$2(x-5)(x-2) = 0$

$x = 5$ or $x = 2$

(2) c) $3 + 5x = 2x^2$

$2x^2 - 5x - 3 = 0$

-6 → -6, +1

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

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

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

$x = -1/2$ $x = 3$

(2) d) $5x^2 - 7x - 6 = 0$

-30 → -10, +3

$5x^2 - 10x + 3x - 6 = 0$

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

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

$x = -\frac{3}{5}$ or $x = 2$

(2) e) $4x^2 - 8x + 4 = 0$

1 → -1, -1 → -2

$4(x^2 - 2x + 1) = 0$

$4(x-1)^2 = 0$

$x = 1$

(2) f) $4x^2 - 9 = 0$

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

$x = \frac{3}{2}$ $x = -\frac{3}{2}$

(6) 5. Determine the **a)** Roots, **b)** Axis of symmetry, **c)** Vertex and **d)** state the maximum or minimum value for the function $f(x) = 2x^2 + 9x - 18$

-36 → -12, +3

$f(x) = 2x^2 + 12x - 3x - 18$

$= 2x(x+6) - 3(x+6)$

$= (2x-3)(x+6)$

a) Roots: $2x - 3 = 0$ or $x + 6 = 0$

$x = 3/2$ $x = -6$

b/c) Axis of Symmetry & Vertex $x = \frac{\frac{3}{2} + -6}{2} = -2.25$

$x = -2.25$

d) $y = 2(-2.25)^2 + 9(-2.25) - 18$

$= 2(5.0625) - 20.25 - 18$

$= -28.125$

min. ↓

$(-2.25, -28.125)$

MCF3M1 Mid Term Exam Review Name: _____

Date: _____

(3) 6. **Without solving,** classify each of the following equations as having either 2 different real roots, 1 real root, or no real roots. Use discriminant $\Rightarrow b^2-4ac$

a) $4x^2 - 4x + 1 = 0$

$a=4\ b=-4\ c=1$

b^2-4ac

$=(-4)^2-4(4)(1)$

$=16-16$

$=0$ $\therefore$ 1 root

b) $3x^2 - 5x - 8 = 0$

$a=3\ b=-5\ c=-8$

b^2-4ac

$=(-5)^2-4(3)(-8)$

$=25+96$

$=121$

$121>0$ $\therefore$ 2 roots

c) $4x^2 - 9x + 11 = 0$

$a=4\ b=-9\ c=11$

b^2-4ac

$=(-9)^2-4(4)(11)$

$=81-176$

$=-95$

$-95<0$

$\therefore$ no roots

7. Write in vertex form by completing the square.

(3) a) $x^2 - 8x + 21$

$=(x^2-8x\quad)+21$

$=(x^2-8x+16-16)+21$

$=(x-4)^2-16+21$

$=(x-4)^2+5$

(3) b) $-5x^2 - 20x - 16$

$=-5(x^2+4x\quad)-16$

$=-5(x^2+4x+4-4)-16$

$=-5(x^2+4x+4)+20-16$

$=-5(x+2)^2+4$

8. Solve using the quadratic formula.

(2) a) $x^2 - 8x - 10 = 0$

$a=1\ b=-8\ c=-10$

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

$=\dfrac{-(-8)\pm\sqrt{(-8)^2-4(1)(-10)}}{2(1)}$

$=\dfrac{8\pm\sqrt{64+40}}{2}$

$=\dfrac{8\pm\sqrt{104}}{2}$

$\therefore x=\dfrac{8+\sqrt{104}}{2}$ or $x=\dfrac{8-\sqrt{104}}{2}$

$x=\dfrac{8+10.2}{2}=9.1$ or $x=\dfrac{8-10.2}{2}=-1.1$

(2) b) $2x^2 + x = 7$

$2x^2+x-7=0$

$a=2\ b=1\ c=-7$

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

$=\dfrac{-1\pm\sqrt{1^2-4(2)(-7)}}{2(2)}$

$=\dfrac{-1\pm\sqrt{1+56}}{4}$

$=\dfrac{-1\pm\sqrt{57}}{4}$

$=\dfrac{-1\pm7.55}{4}$

$\therefore x=\dfrac{-1+7.55}{4}$ or $x=\dfrac{-1-7.55}{4}$

$x=3.275$ & $x=-2.1375$

9. A rock is thrown into the air from a bridge and falls into the water below. The height of the rock, h metres, relative to the water t seconds after being thrown is given by $h(t) = -5t^2 + 25t + 120$.

(2) a) After how many seconds does the rock hit the water?

$-5t^2 + 25t + 120 = 0$

$-5(t^2 - 5t - 24) = 0$

$-5(t-8)(t+3) = 0$

$\therefore$ **$t = 8$** or $t = -3$

-24
×
-8 +3
+
-5

(1) b) After how many seconds does the rock reach the maximum height?

max. height occurs at axis of symmetry

$t = \frac{8 + -3}{2} =$ **2.5 s**

(2) c) Determine the maximum height of the rock above the water.

$h(2.5) = -5(2.5)^2 + 25(2.5) + 120$

$= -5(6.25) + 62.5 + 120$

$= -31.25 + 62.5 + 120$

$=$ **151.25 m**