A∞Ω
MATH@TD

MCR3U

Name: ______________________

Unit 3 Practice Test – Quadratic Functions

vertex form: $f(x) = -(x-h)^2 + k$
vertex $(AoS, f(AoS)) = (1, f(1))$

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

K ___/10 **T**____/9 **C** ___/7 **A** ____/15

1. a) Graph $f(x) = -(x+1)(x-3)$ *(Also draw the AoS on your graph).* **K/10**

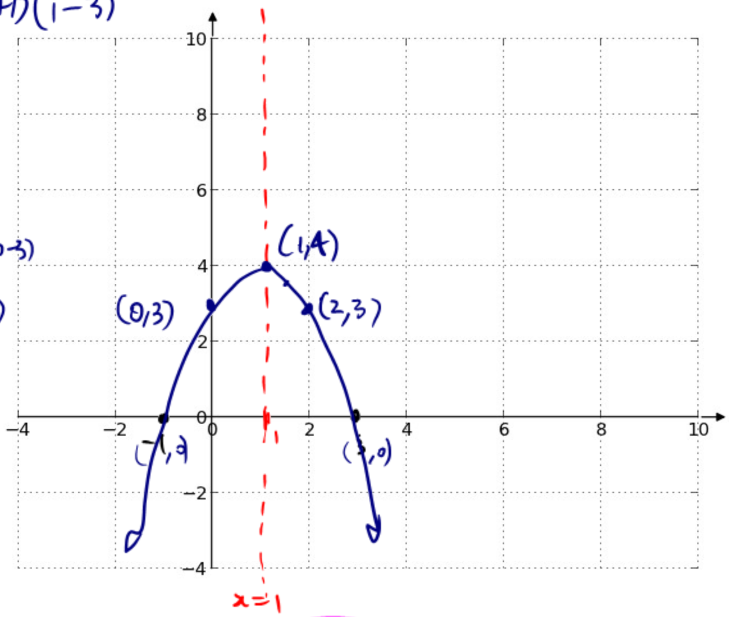
$-(x+1)(x-3) = 0 \Rightarrow x = -1, 3$

$x = \frac{-1+3}{2} = 1$

y_{int} $(0, f(0))$

$f(1) = -(1+1)(1-3)$
$= -(2)(-2)$
$= 4$

$f(0) = -(0+1)(0-3)$
$= -(1)(-3)$



b) Determine:

AoS is $x =$ __1__.

Vertex is (__1__, __4__).

y_{int} = (__0__, __3__).

Symmetric Partner of y_{int}:
(__2__, __3__).

Zeros are: (__−1__, __0__) and
(__3__, __0__).

$f(x) = -(x+1)(x-3)$
$= -[x^2 - 3x + x - 3]$
$= -(x^2 - 2x - 3) = -x^2 + 2x + 3$

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

c) This parabola opens __down__. The vertex contains a __max__ (max or min?) value.

d) Re-write the function in standard form: $f(x) =$ __$-x^2 + 2x + 3$__

$f(x) = ax^2 + bx + c$

e) Re-write the function in vertex form: $f(x) =$ __$-(x-1)^2 + 4$__

$f(x) = a(x-h)^2 + k$ $\qquad (h,k) = (1,4)$

VERTEX

2. At a Toronto Maple Leafs game workers shoot T-shirts to the fans using a sling shot. The height of a T-shirt is modelled by the function $h(t) = -5t^2 + 20t + 1$ where $h(t)$ is in metres above the ice rink, and t is in seconds after the T-shirt is shot. Determine the $\boxed{\text{maximum}}$ height a T-shirt could reach, and how long it would take to reach that maximum height. **T/3**

$a = -5 \quad b = 20 \quad c = 1$

$h(t) = at^2 + bt + c$

Vertex = (AoS, h(AoS))

$AoS = x = \dfrac{-b}{2a} = \dfrac{-(20)}{2(-5)} = \dfrac{-20}{-10} = 2$

$h(2) = -5(2)^2 + 20(2) + 1 = 21$

vertex $(2, h(2)) = (2, 21)$

$\therefore$ The max height is 21 m and happens at $t = 2$ seconds.

3. Write the equation for each function in any form you choose. (Show your work) **T/4**

a) Equation: $f(x) =$ ____________________

$f(x)$ has zeros at $x = -3$ and at $x = 2$.

$f(x)$ also passes through $\boxed{P(1,8)}$

$(x, f(x))$

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

$\Rightarrow f(x) = a(x + 3)(x - 2)$

using $(1, 8)$

$\Rightarrow 8 = a(1 + 3)(1 - 2)$

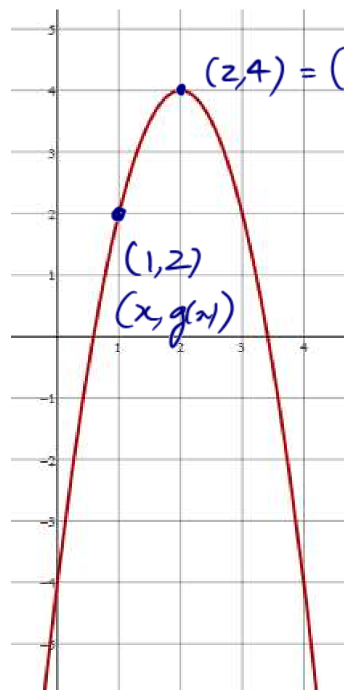
$\Rightarrow 8 = a(4)(-1)$

$\dfrac{8}{-4} = \dfrac{-4a}{-4}$ $\rightarrow a = -2$

$\therefore f(x) = -2(x + 3)(x - 2)$

b) Equation: $g(x) =$ ____________________

$g(x)$



$g(x) = a(x - h)^2 + k$

$\Rightarrow g(x) = a(x - 2)^2 + 4$

using $(1, 2)$

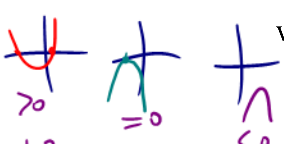
$2 = a(1 - 2)^2 + 4$

$2 - 4 = a + 4 - 4$

$a = -2$

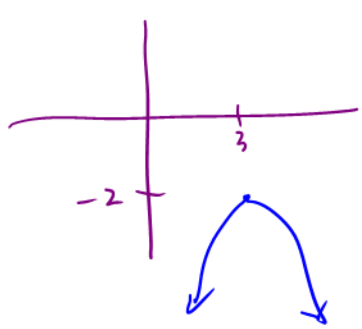
$\therefore g(x) = -2(x - 2)^2 + 4$

4. Given the quadratic function $g(x) = -\frac{2}{3}(x - 3)^2 - 2$ ***state*** how many zeros $g(x)$ has, with a reason. Note: you may not use the quadratic formula nor the discriminant. **T/2**



$b^2 - 4ac$

$g(x) = a(x - h)^2 + k$



negative max $\Rightarrow$ No zeros

$g(x) = ax^2 + bx + c$

5. Simplify: **A/4**

$$3\sqrt{2}\left(4\sqrt{6}-1\sqrt{10}\right)-1\left(5\sqrt{3}+3\sqrt{20}\right)$$

$= 12\sqrt{12} - 3\sqrt{20} - 5\sqrt{3} - 3\sqrt{20}$

$= 12\sqrt{4\times3} - 3\sqrt{4\times5} - 5\sqrt{3} - 3\sqrt{4\times5}$

$= 12(2)\sqrt{3} - 3(2)\sqrt{5} - 5\sqrt{3} - 3(2)\sqrt{5}$

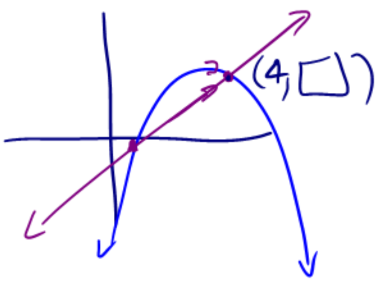
$= 24\sqrt{3} - 6\sqrt{5} - 5\sqrt{3} - 6\sqrt{5}$

$= 19\sqrt{3} - 12\sqrt{5}$ //

6. 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 nefarious young girl 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? **A/5**

4

g(4) or f(4)



$$-5t^2+20t+15 = 3t+3 \qquad \text{(}-3t\text{, } -3\text{)}$$

| stuff = 0

$\Rightarrow -5t^2+17t+12=0$

$a=-5 \quad b=17 \quad c=12$

QF.

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

$$=\frac{-17\pm\sqrt{(17)^2-4(-5)(12)}}{2(-5)}$$

$$=\frac{-17\pm23}{-10}$$

$\therefore\ t=\dfrac{-17+23}{-10}$ or $t=\dfrac{-17-23}{-10}$

$=\dfrac{6}{-10}$ $\qquad =\dfrac{-40}{-10}$

$=-0.6$ $\qquad = +4$ sec.

inadmissible

∴ The paint ball will hit the baseball at 4 seconds at a height of

$g(4)=3(4)+3$

$=15$ m

(the soln to system (4, 15)

7. Using algebraic techniques determine the zeros of the functions (if necessary leave answers in radical form. But, if you must use decimals, round to two decimal places):

a) $f(x)-2x^2+x+5$ b) $g(x)=2(x-3)^2-20$ **A/3,3**

9. Explain why a vertex is NOT considered a maximum or a minimum. **C/2**

10. Tell me **everything** you can about the given parabola. You may use words and/or numbers in your description. In fact, label ***anything of importance***. **C/5**