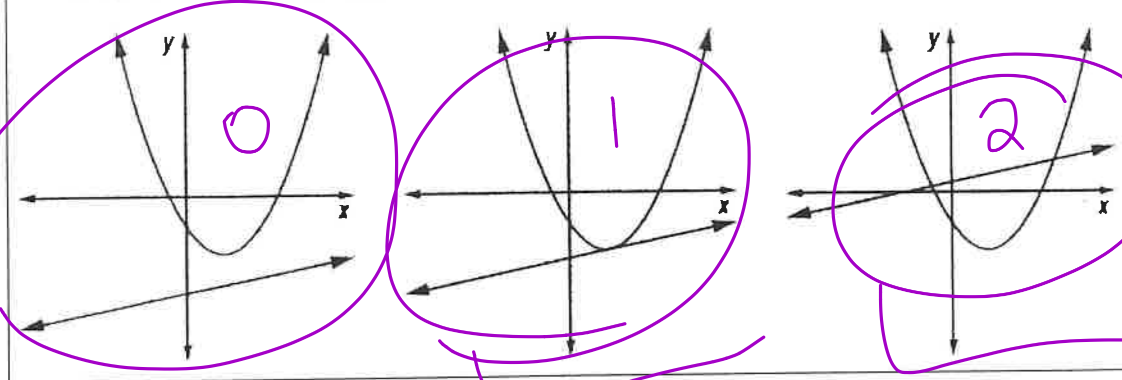
Math 2 – Honors
Unit 3 – Quadratic Functions Continued
Lesson 5 → Linear vs. Quadratic Systems

Name________________________
Date____________________Pd_____

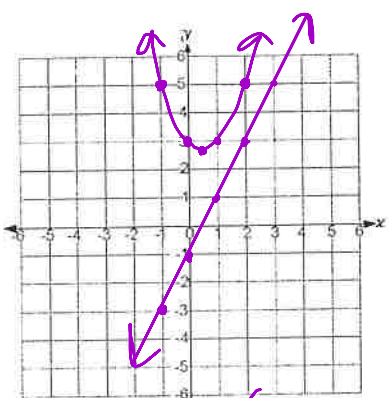
➢ When a linear function and a quadratic function are graphed on the same coordinate plane, the graphs below represent the possible number of solutions for the system of equations.

0, 1, or 2 solutions can be found.



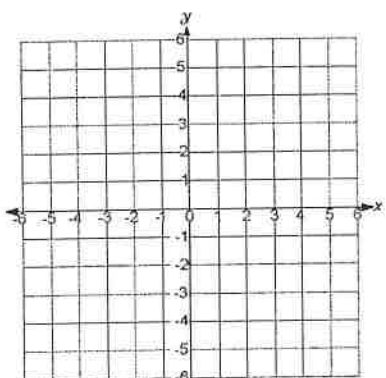
➢ Solve each system of equations **graphically**:

$y = x^2 - x + 3$
$y = 2x - 1$



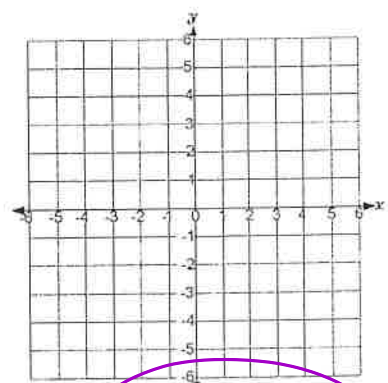
$(x, y) =$ ∅

$y = x^2 - 3x + 2$
$y = x - 2$



$(x, y) =$ (2,0)
X = 2

$y = 10x^2 - 28x - 39$
$y = 2x + 1$



$(x, y) =$ X = −1, 4

➢ Solve each system of equations **algebraically**:

$y = x^2 - x + 3$
$y = 2x - 1$

$2x - 1 = x^2 - x + 3$
$-2x + 1 \quad -2x + 1$
$0 = x^2 - 3x + 4$
$\frac{+3 \pm \sqrt{9 - 4(1)(4)}}{2}$
$\frac{3 \pm \sqrt{-7}}{2} \to \varnothing$

$(x, y) =$

$y = x^2 - 3x + 2$
$y = x - 2$

$x - 2 = x^2 - 3x + 2$
$-x + 2 \quad -x + 2$
$0 = x^2 - 4x + 4$
$0 = (x-2)(x-2)$
$x = 2$

$(x, y) =$ (2,0)

$y = 10x^2 - 28x - 39$
$y = 2x + 1$

$10x^2 - 30x - 40$
$10(x^2 - 3x - 4)$
$10(x-4)(x+1) = 0$
$10 \neq 0 \quad x = 4 \quad x = -1$

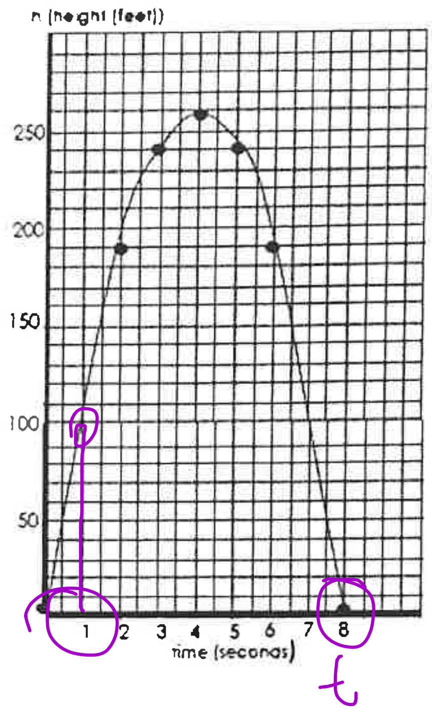
$(x, y) =$ (4, 9)
(−1, −1)

8 4 X = 2

$\frac{0}{4} = \frac{1}{2} = 2$ $\frac{4}{8} = \frac{2}{4}$ $\frac{1}{2}$

Quadratic Functions – Applications Name________________________

1.) Using the graph at the right, it shows the **height h** in feet of a small rocket **t seconds** after it is launched. The path of the rocket is given by the equation:
h = -16t² + 128t.



a.) How long is the rocket in the air? 8sec

b.) What is the greatest height the rocket reaches? 256

c.) What does $\boxed{f(1)}$ mean in this context? → x-axis

What is height at 1 second

d.) Find $f(1)$ 112

→ y-axis

e.) What would $f(x) \boxed{=} 0$ mean in this context?

what time at height of zero

f.) Find $f(x) = 0$ At 0 + 8 seconds

g.) Find $f(2)$. Is it going up or down (increasing or decreasing)?

x=2 192 feet up => inc

h.) Find $f(6)$. Is it going up or down (increasing or decreasing)?

x=6 192 feet down => dec

i.) What is the domain?

[0, 8]

j.) What is the range?

[0, 256]

Find $f(x) = 138$

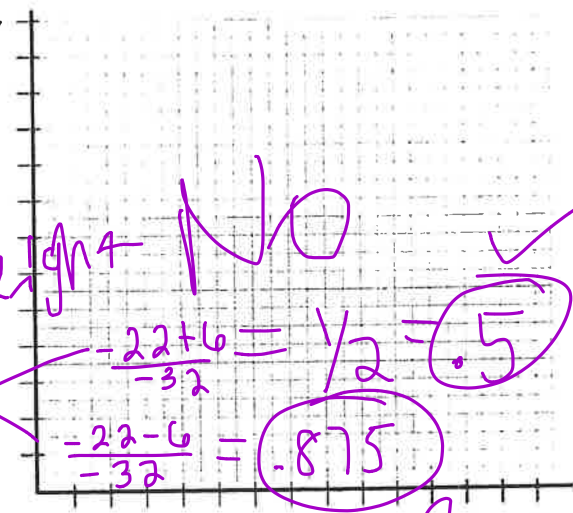
time at height 138

1.28 , 6.72

➢ Applications of Linear/Quadratic Systems:

Example #1: A ball thrown is modeled by the function: $y = -16x^2 + 22x + 3$.
Using what you know about quadratic functions, answer the following questions.

1) Sketch the graph : No



2) Given the context of the problem, what is an appropriate domain and range for the graph?

D: [0, 1.5] R: [0, 10.56]

height No

3) Write an equation to show when the ball will be **exactly** 10 feet in the air and then solve.

$10 = -16x^2 + 22x + 3$
$0 = -16x^2 + 22x - 7$

$\dfrac{-22 \pm \sqrt{(22)^2 - 4(-16)(-7)}}{2(-16)} = \dfrac{-22 \pm \sqrt{36}}{-32}$

$\dfrac{-22+6}{-32} = \frac{1}{2} = .5$

$\dfrac{-22-6}{-32} = .875$

4) Write an inequality to show when the ball will be at a height less than 10 feet in the air and then solve.

[0, .5) ∪ (.875, 1.5]

time

5) Write an inequality to show when the ball will be at a height **higher than** 10 feet in the air and then solve.

(.5, .875)

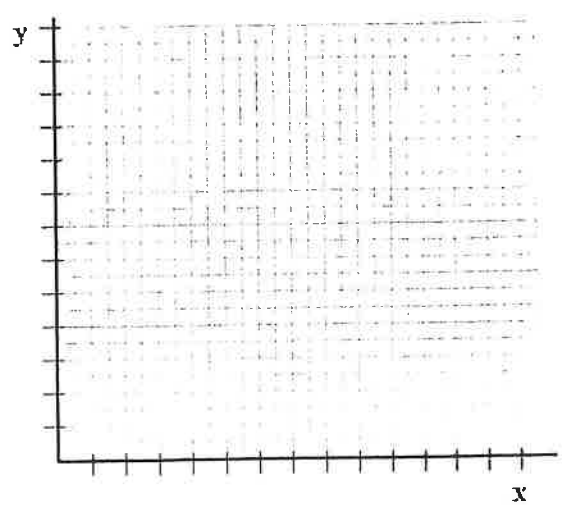
6) $f(1.25)$
$x = 1.25$
$\boxed{= 5.5}$
$\boxed{\text{time } 1.25}$

7) $f(x) = 7.2$
$y = 7.2$
$\boxed{\approx .23 \text{ \& } 1.15 \text{ sec.}}$
height 7.2

Example #2: The student council decides to put on a concert to raise money for an after school program. They have determined that the price of the ticket will affect their profit. The functions shown below represent their potential income and cost of putting on the concert, where t represents ticket price.

Income: $I(t) = -30t^2 + 330t$ **Cost:** $C(t) = -30t + 330$

1) Sketch the graph of each function:



2) Find algebraically and graphically the **break-even** point. (Hint: $Income = Cost$)

Ticket = 1$
11$

3) Write an inequality to show where the cost is greater than the income and then solve.

[0, 1)

4) Write an inequality to show where the income is greater than the cost and then solve.

5) Which ticket price would you use in order to maximize your profit? Where is this shown on the graph?

$ 5.50