Warmup:

Factor the following polynomials:

$x^2 + 7x + 6$ = $(x+1)(x+6)$

$x^2 - 9x - 10$

$= (x-10)(x+1)$

Perfect Square

$x^2 + 8x + 16$ = $(x+4)(x+4)$

$= (x+4)^2$

$x^2 + 0x - 9$

-9

$-3 \times +3$

0

$x^2 - 9$

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

Difference of Squares

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

$$(3)(5) = 15$$

$$x^2 + 9x + 8 = \boxed{(x+8)(x+1)}$$

$8 = 4 \cdot 2$

$= \underline{2 \cdot 2 \cdot 2}$

$\neq \underline{x+8 \quad x+1}$

$\neq \underline{\begin{matrix}(x+8)\\(x+1)\end{matrix}}$

$\neq \underline{\begin{matrix}x+8\\x+1\end{matrix}}$

$$x + 2x - 3 = 3x - 3$$

$(x+2)$

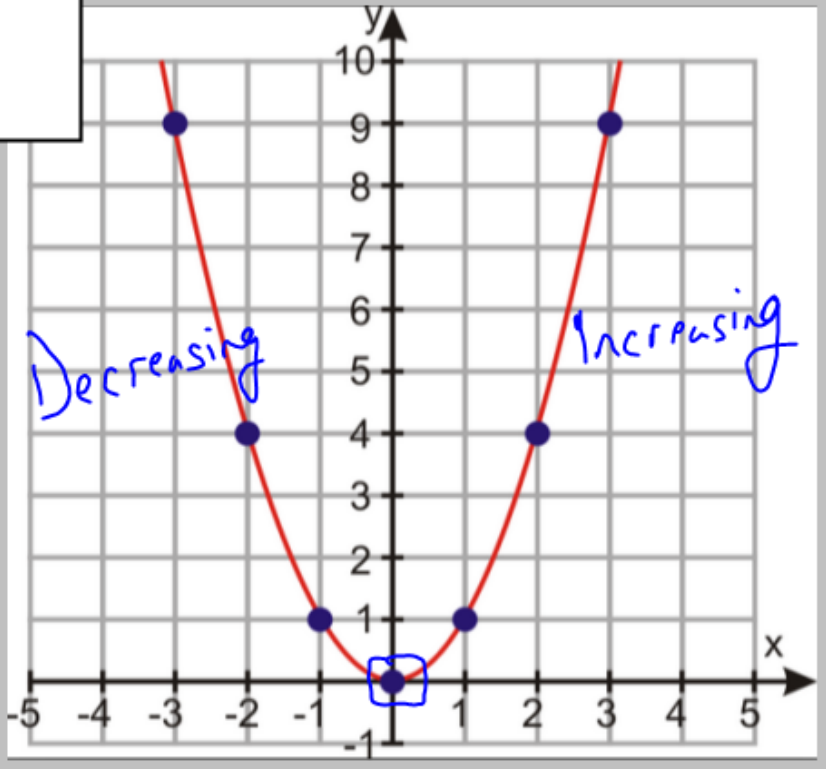
$(x-3)$

Unit 3:

Modeling and Analyzing Quadratic Functions

Parent Function

$$y=x^2$$



X	Y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

vertex

Symmetry

Factored Form

$y=(x+1)(x-3)$

Standard Form

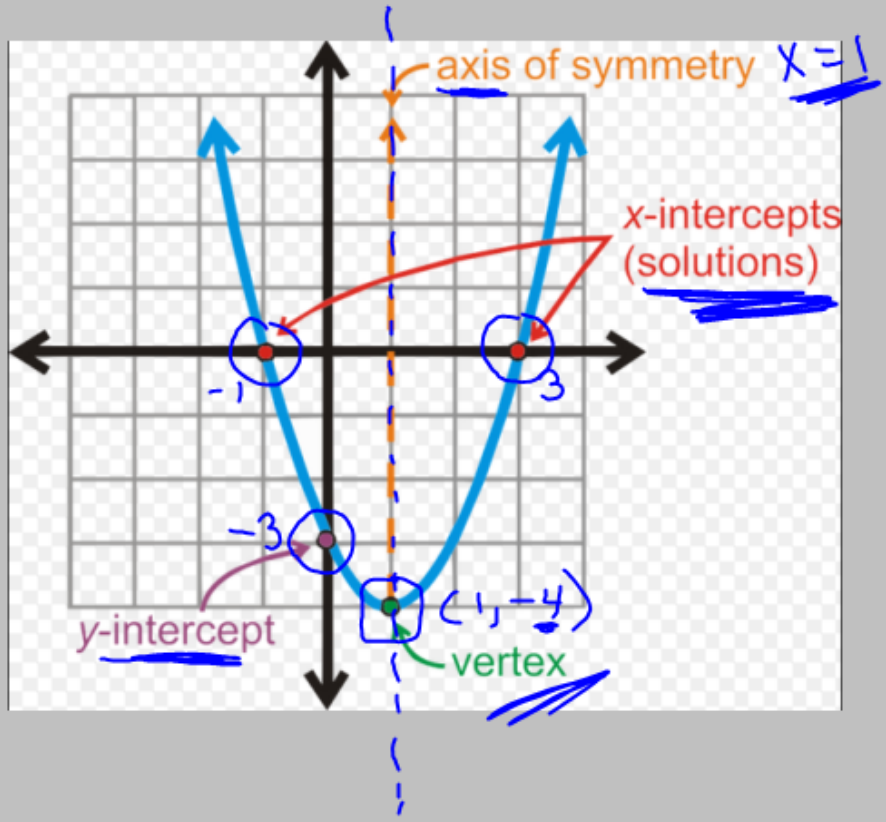
$y=x^2-2x-3$

y-int.

Vertex Form

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

X	Y
-2	5
-1	0
0	-3
1 vertex	-4
2	-3
3	0
4	5



Factored Form

$y=-x(x+4)$

$-(x+0)(x+4)$

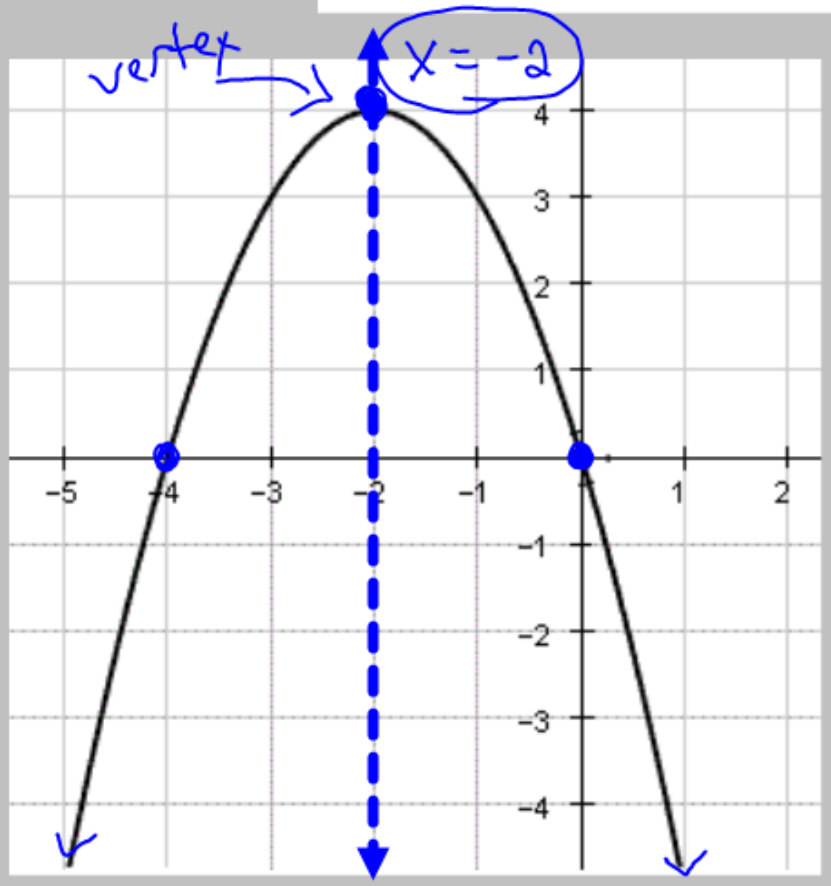
Standard Form

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

Vertex Form

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

X	Y
-5	-5
-4	0
-3	3
-2	4
-1	3
0	0
1	-5



Three Forms of a Quadratic Equation

Standard Form

$$y = ax^2 + bx + c$$

y-int = "c"

Factored Form

$$y = a(x - r_1)(x - r_2)$$

r_1 & r_2 = "roots"

x-intercepts

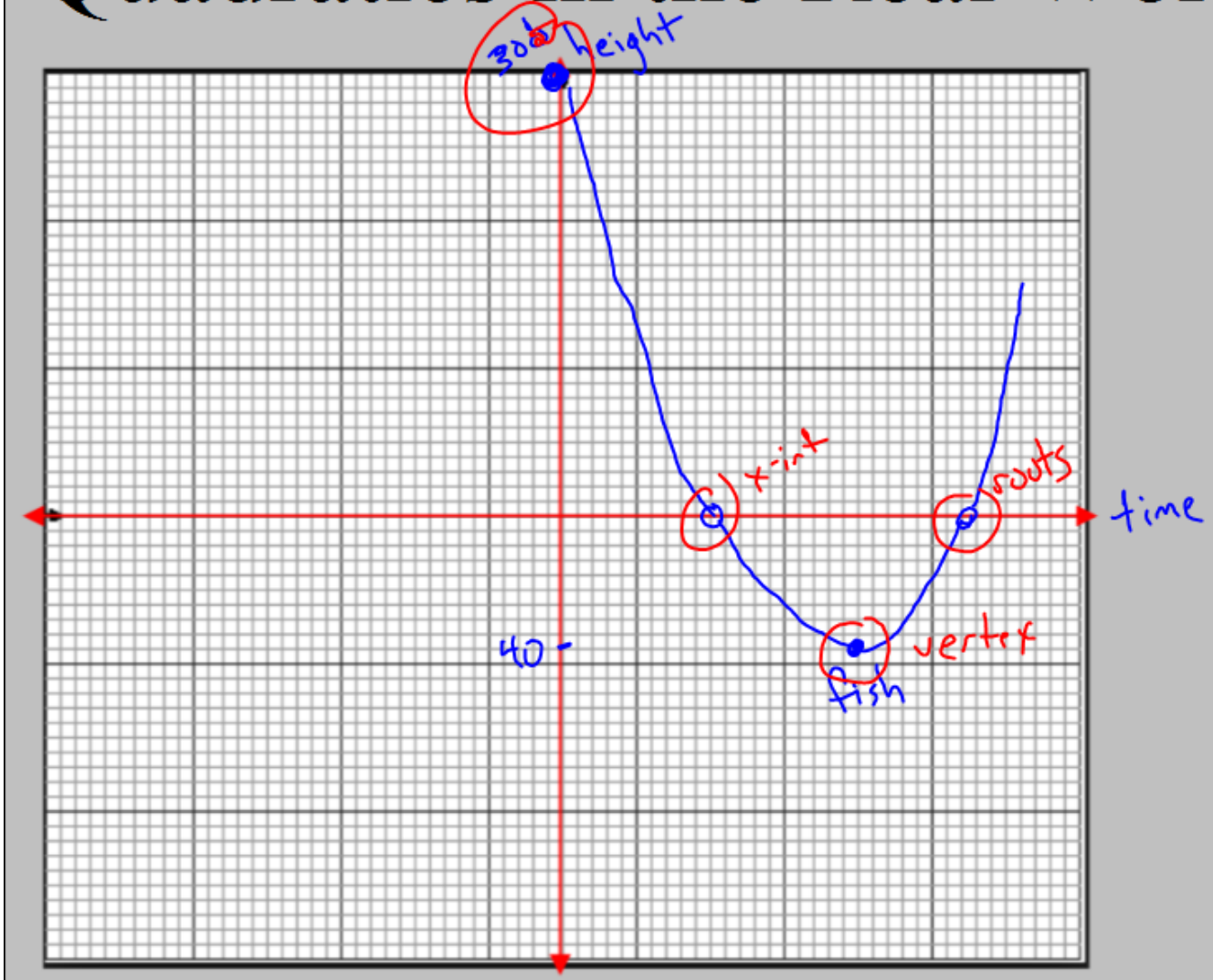
zeroes

Vertex Form

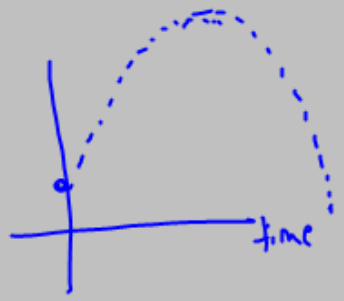
$$y = a(x - h)^2 + k$$

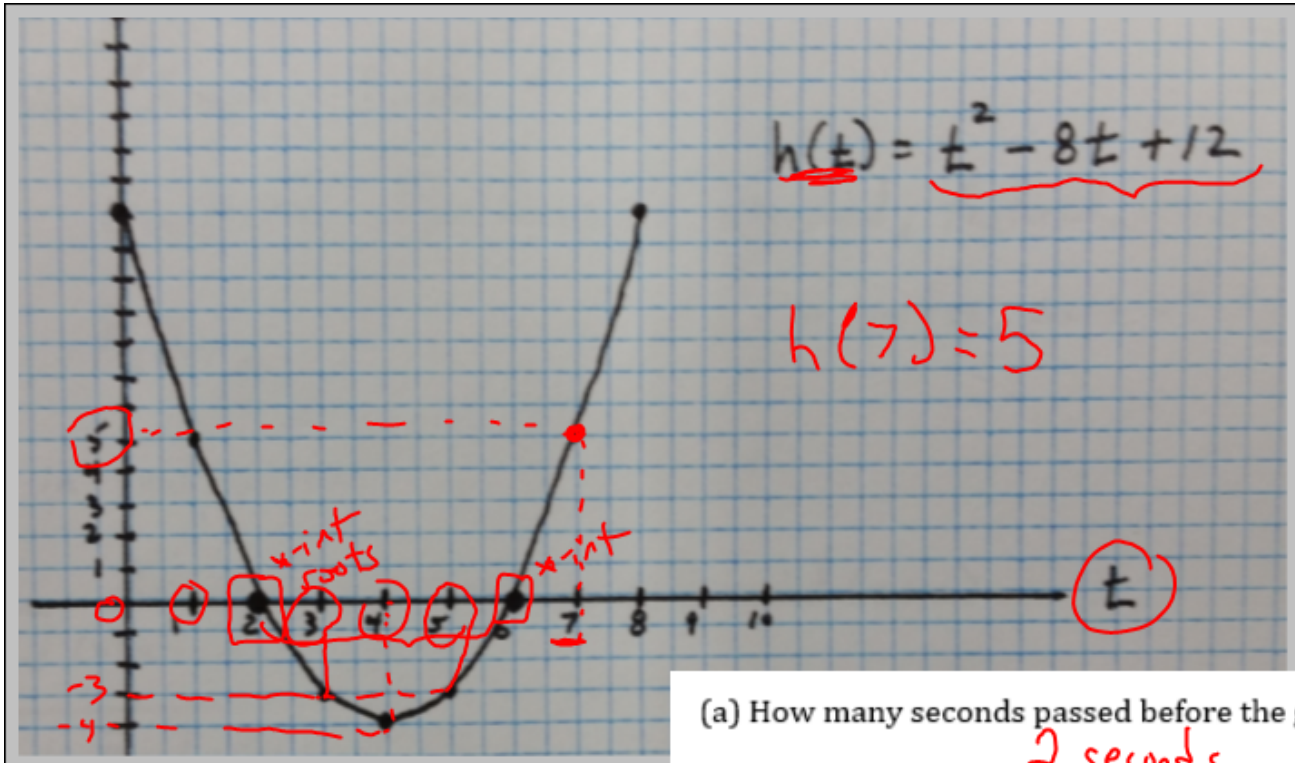
vertex (h, k)

Quadratics in the Real World



weirdest-cape-gannets





Gannet's Dive

$h(t) = -3$

$t = 3$

$t = 5$

$h(t) = t^2 - 8t + 12.$

Let h(t) = the birds height (meters)
Let t = time in seconds

vertex

(a) How many seconds passed before the gannet entered the water? 2 seconds

(b) After how many seconds did the gannet come back out of the water? 6 seconds

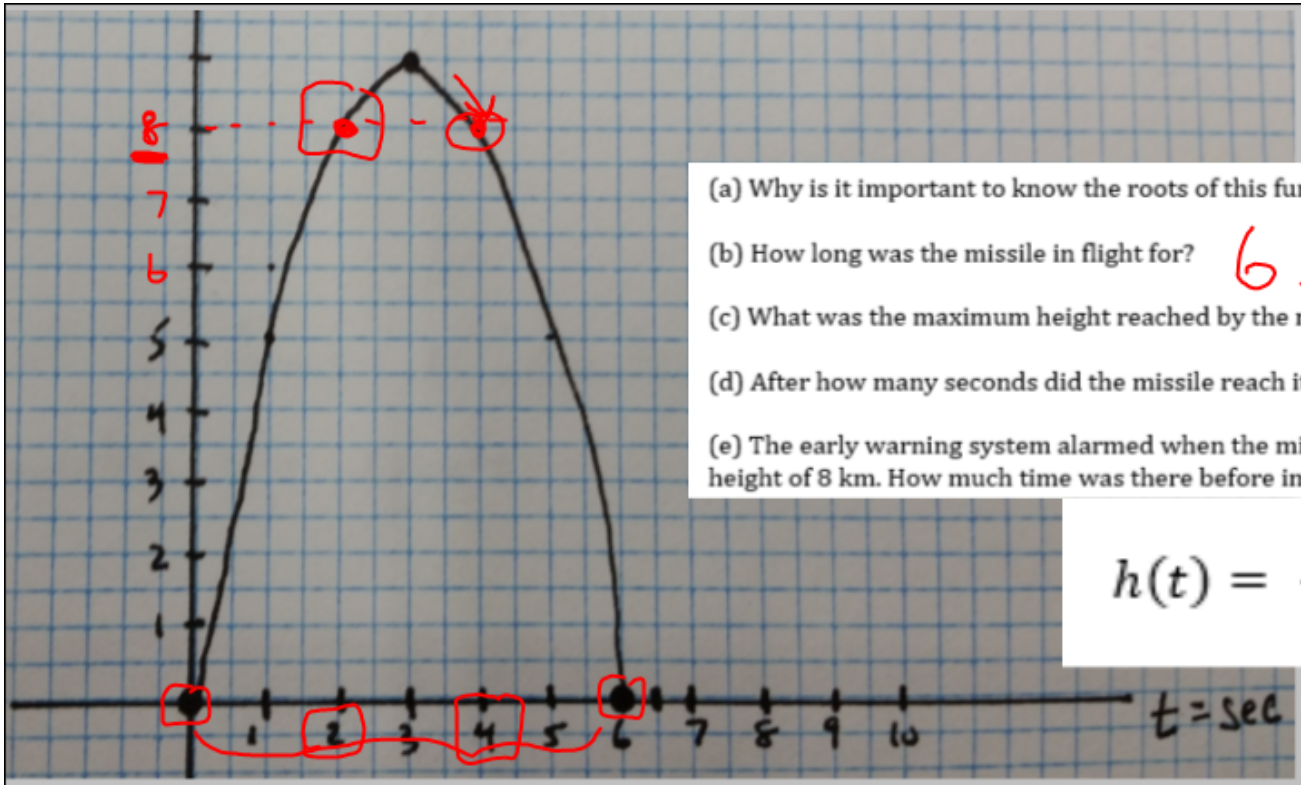
(c) How long was the gannet underwater for? 4 seconds

(d) What was the deepest dive of the gannet? 4 meters

(e) After how many seconds was the gannet at its deepest? 4 seconds

(f) After 7 seconds the gannet burped and dropped its fish. At what height did this occur? 5 meters

Tomahawk Missile



(a) Why is it important to know the roots of this function? What do the roots tell us?

(b) How long was the missile in flight for? 6 seconds

(c) What was the maximum height reached by the missile? 9km

(d) After how many seconds did the missile reach its maximum height? 3 seconds

(e) The early warning system alarmed when the missile was descending and reached a height of 8 km. How much time was there before impact? 2 seconds

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

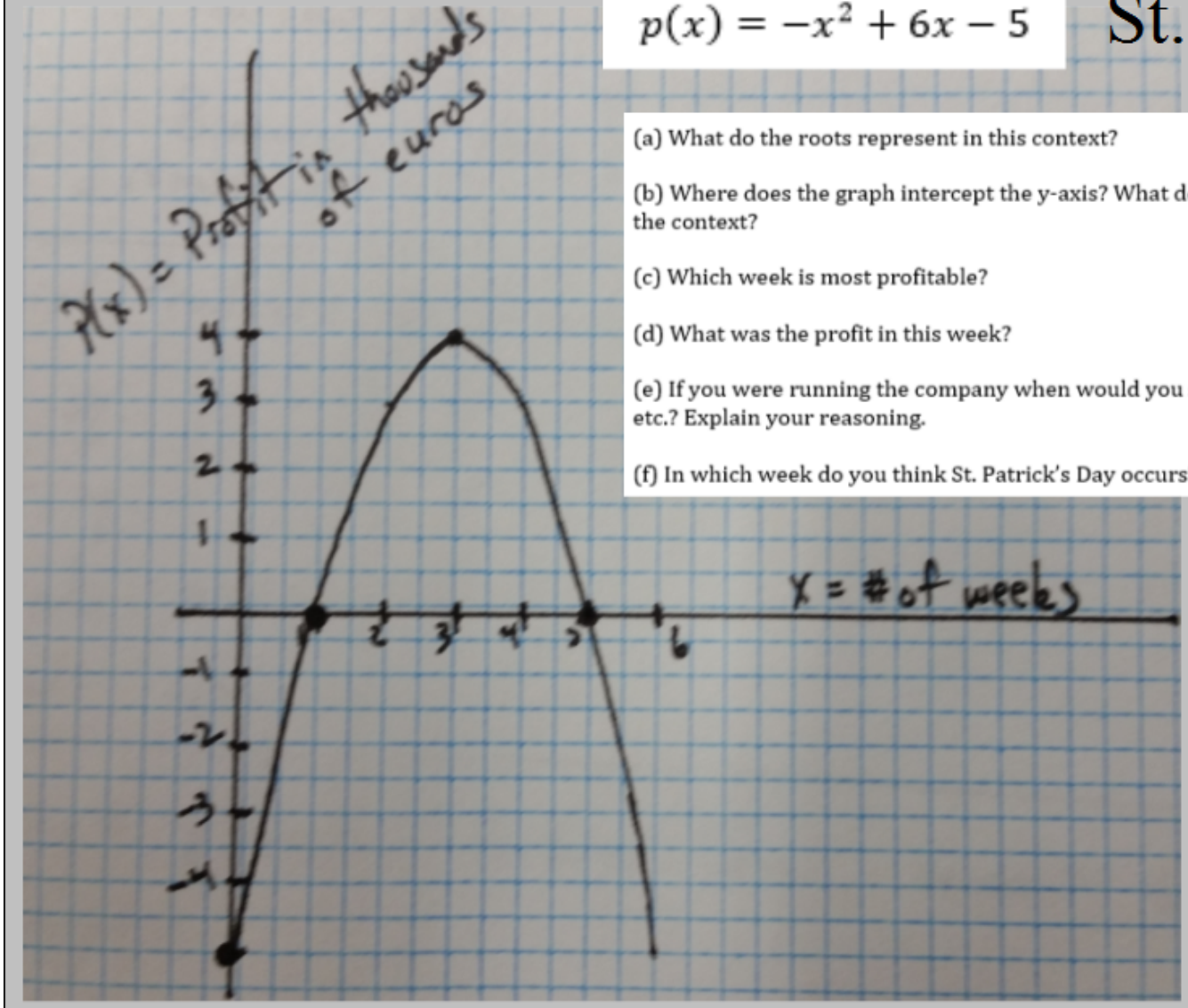
Extension Question 1: Missiles only become detectable by RADAR above a height of 8 km. How many seconds of warning will a ship equipped with RADAR have before being struck by the missile? 4 seconds

Extension Question 2: A ship can move at a speed of 150 m/s. To be safe from a missile strike, it must be at least 500m away from the impact location. Will the ship make it to safety in time?

$4\,\text{sec} \cdot 150\,\text{m/s} = 600\,\text{m}$

St. Patrick's Day

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



(a) What do the roots represent in this context?

(b) Where does the graph intercept the y-axis? What do you think this value represents in the context?

(c) Which week is most profitable?

(d) What was the profit in this week?

(e) If you were running the company when would you stop manufacturing flags, shamrocks etc.? Explain your reasoning.

(f) In which week do you think St. Patrick's Day occurs? Explain your reasoning.

Summary Questions!!

What did we learn today?