CHAPTER 2A Review - SOLUTIONS

(1.) $f(x) = 3x^2 + 18x + 31$

Algebraically

$y = 3(x^2 + 6x + 3^2) + 31 + \underline{-27}$

$= 3(x+3)^2 + 4$

Vertex $(-3, 4)$ opens up w/ minimum

or

$x = \frac{-b}{2a} \Rightarrow x = \frac{-18}{2(3)} = -3$

$y = 3(-3)^2 + 18(-3) + 31$

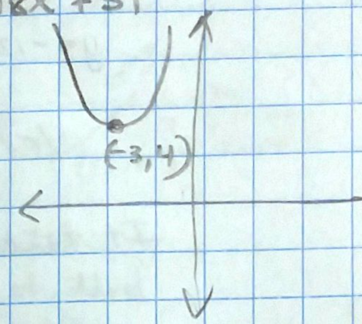
$y = 4$

vertex $(-3, 4)$ opens up.

Graphically

$y_1 = 3x^2 + 18x + 31$

xmin = −10
xmax = 10
ymin = −10
ymax = 10



$y = a(x+3)^2 + 4$

(use table to find another point)

$(1, 52)$

$52 = a(1+3)^2 + 4$

$52 = 16a + 4$

$48 = 16a$

$3 = a$

$y = 3(x+3)^2 + 4$

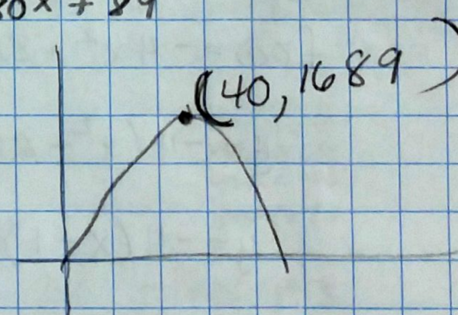
(2.) $y = -4(x-3)^2 - 7$

Vertex $(3, -7)$
opens down

(3.) use calculator to find maximum

$y_1 = -x^2 + 80x + 89$

xmin = 0
xmax = 200
ymin = 0
ymax = 2000



2nd CALC
4: maximum

John must sell 40 hotdogs to earn the most profit.

4. $h(t) = -12t^2 + 480t$

<u>Algebraically</u>

$y = -12(t^2 - 40t + \underline{20^2}) + \underline{4800}$

$y = -12(t-20)^2 + 4800$

Vertex $(20, 4800)$

It takes 20 sec for the ball to reach its maximum.

$0 = -12(t-20)^2 + 4800$
$-4800 = -12(t-20)^2$
$400 = (t-20)^2$
$\pm\sqrt{400} = t - 20$
$\pm 20 = t - 20$
$20 \pm 20 = t$
$t = 40 \quad t = 0$

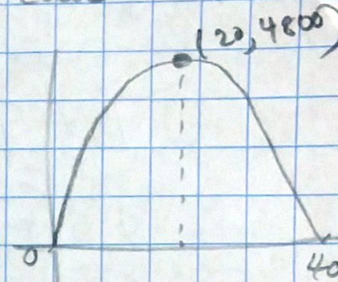
It will hit the ground after 40 seconds.

<u>Graphically</u>

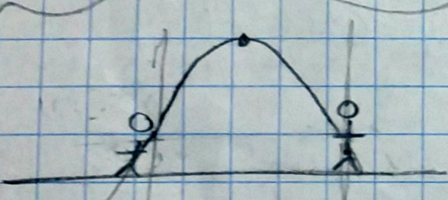
$y_1 = -12t^2 + 480t$

find maximum using 2nd calc -> 4: maximum

Xmin = 0
Xmax = 50
ymin = 0
ymax = 5000



vertex/maximum splits the intercepts so it will hit ground after 40 seconds.



5. vertex, maximum

6. maximum @ $(1, 4)$ maximum height is 4 units at $X = 1$

$f(x) = -4x^2 + 8x$

$y = -4(x^2 - 2x + \underline{1^2}) + \underline{+4}$

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

Vertex $(1, 4)$

7. $y = 4x^2 - 8x + 14$

Using "complete the square"!

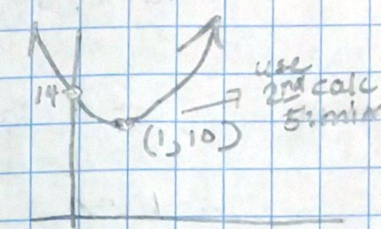
$y = 4(x^2 - 2x + \underline{1^2}) + 14 + \underline{-4}$

$\boxed{y = 4(x-1)^2 + 10 \quad \text{vertex } (1, 10)}$

using graphing calculator

$y_1 = 4x^2 - 8x + 14$

Xmin = -10
Xmax = 10
ymin = -10
ymax = 20



$y = a(x-1)^2 + 10$

find a $\rightarrow$ $4x^2 - 8x + 14$

$a = 4$

so,

$\boxed{y = 4(x-1)^2 + 10}$

8. $f(x) = -x^2 + 2x - 9$ (opens down, y-intercept @ -9)

Algebraically

$y = -1(x^2 - 2x + \underline{1^2}) - 9 + \underline{+1}$

$y = -1(x-1)^2 - 8$

vertex $(1, -8)$

$0 = -1(x-1)^2 - 8$

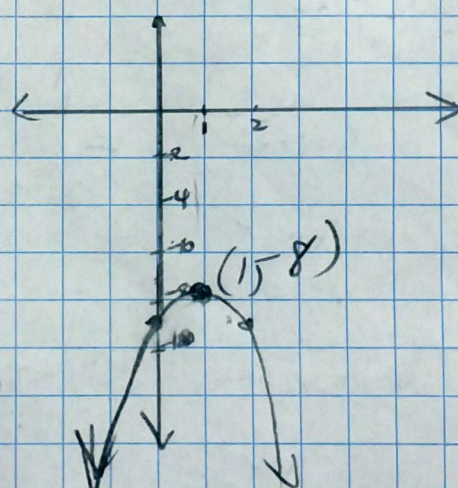
$8 = -1(x-1)^2$

$-8 = (x-1)^2$

$\pm\sqrt{-8} = x - 1$

$\rightarrow$ No real X-intercepts

y-intercep $(0, -9)$



Calculator

$y_1 = -x^2 + 2x - 9$

Xmin = -10
Xmax = 10
ymin = -10
ymax = 10

No intercepts.

y-intercept $(0, -9)$

13. Vertex $(3,-4)$ point $(2,6)$

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

$y = a(x-3)^2 - 4$

find a by plugging in $(2,6)$

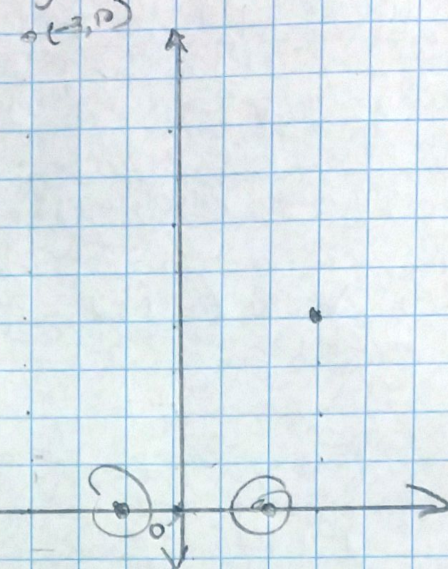
$6 = a(2-3)^2 - 4$

$6 = a - 4$

$10 = a$

$\boxed{y = 10(x-3)^2 - 4}$

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



$(-3, 10)$
$(-1, 0)$ } x-intercepts
$(2, 0)$
$(3, 4)$

$y = a(x-(-1))(x-2)$

$y = a(x+1)(x-2)$

$y = a(x^2 - x - 2)$

plug in $(3,4)$ to find a

$4 = a(3^2 - 3 - 2)$

$4 = a(4)$

$\boxed{1 = a}$

So, $\boxed{y = 1(x+1)(x-2)} = y = x^2 - x - 2$

Calculator - QuadReg

L1	L2
-3	10
-1	0
2	0
3	4

$y = ax^2 + bx + c$

$a = 1$

$b = -1$

$c = -2$

$R^2 = 1$

$\boxed{y = x^2 - x - 2}$

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

$a > 0$ opens up - min

$a < 0$ opens down - max

c is y-intercept

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

$a > 0$ opens up - min

$a < 0$ opens down - max

(h,k) is vertex

$f(x) = a(x-p)(x-q)$

$a > 0$ opens up - min

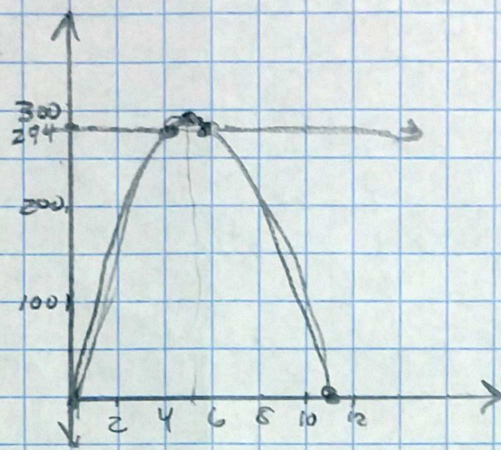
$a < 0$ opens down - max

p, q x-intercepts

9. $h(t) = -9.8t^2 + 107.8t$

Calculator

xmin = 0
xmax = 15
ymin = 0
ymax = 320



$y_1 = -9.8x^2 + 107.8x$

2nd calc
4: maximum

maximum
$x = 5.5$ $y = 296.5$

$y_2 = 294$

2nd calc
5: intersect
(5, 294)
(6, 294)

The rocket will be higher than 294m between 5 and 6 seconds

10. $y = x^2 + 2x - 4$

$x = -b/2a \Rightarrow \frac{-2}{2(1)} = -1$

$y = (-1)^2 + 2(-1) - 4$
$= 1 - 2 - 4$
$= -5$

$\boxed{\text{vertex } (-1, -5)}$

x-intercepts
$0 = (x+1)^2 - 5$
$5 = (x+1)^2$

$\pm\sqrt{5} = x + 1$
$-1 \pm \sqrt{5} = x$

$\boxed{x = -1 + \sqrt{5} \quad x = -1 - \sqrt{5}}$

or by "completing the square"

$y = (x^2 + 2x + \underline{1^2}) - 4 - 1$

$y = (x+1)^2 - 5$

$\boxed{\text{vertex } (-1, -5)}$

(11) $y = -3x^2 - 12x - 3$

$y = -3(x^2 + 4x + \underline{2^2}) - 3 + \underline{12}$

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

$\boxed{\text{vertex } (-2, 9)}$

$0 = -3(x+2)^2 + 9$

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

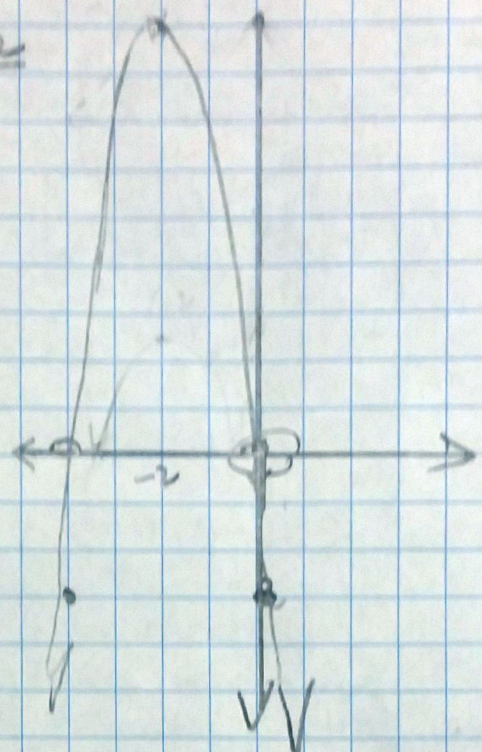
$3 = (x+2)^2$

$\pm\sqrt{3} = x + 2$

$-2 \pm \sqrt{3} = x$

$x = -2 + \sqrt{3}$ $\quad$ $x = -2 - \sqrt{3}$

$x \approx -0.27$ $\quad$ $x \approx -3.7$



(12)

year	# of students
50	190
60	200
70	230
80	280
90	350
100	440

$\boxed{\text{stat}}$

1: edit (Load data into L_1 + L_2)

$\boxed{\text{STAT}} \rightarrow$ CALC

4: LinReg

$y = ax + b$
$a = 5$
$b = -93.33$
$r^2 = 0.921$

$\boxed{y = 5x - 93.33}$

$\boxed{\text{STAT}} \rightarrow$ CALC

5: QuadReg

$y = ax^2 + bx + c$
$a = .1$
$b = -10$
$c = 440$
$r^2 = 1.0$

$\boxed{y = .1x^2 - 10x + 440}$

The quadratic function $y = .1x^2 - 10x + 440$ fits better than the linear function by comparing the r^2.