Polynomial Review Key

1. The roots of a function are $-3, 1, 6-\sqrt{2}i, 6+\sqrt{2}i$

a) What are the x-intercepts?

$\boxed{(-3,0) \text{ and } (1,0)}$

b) $\boxed{(x+3)(x-1)(x-6+\sqrt{2}i)(x-6-\sqrt{2}i) = f(x)}$

c) $(x^2-x+3x-3)(x^2-6x-\cancel{x\sqrt{2}i}-6x+36+\cancel{6\sqrt{2}i}+\cancel{x\sqrt{2}i}-\cancel{6\sqrt{2}i}-2i^2)$

$= (x^2+2x-3)(x^2-6x-6x+36-2(-1))$

$= (x^2+2x-3)(x^2-12x+36+2)$

$= (x^2+2x-3)(x^2-12x+38)$

$= x^4 - \cancel{12x^3} + 38x^2 + \cancel{2x^3} - 24x^2 + 76x - \cancel{3x^2} + 36x - 114$

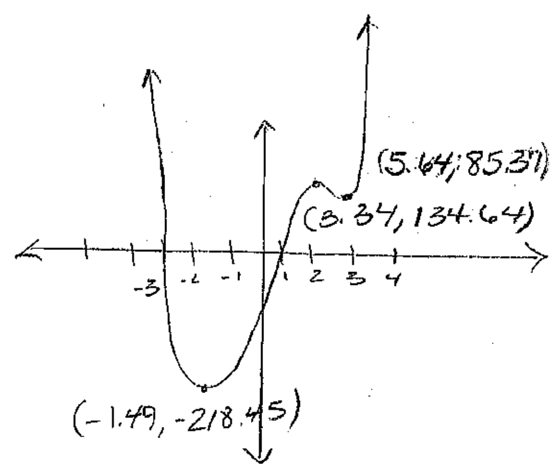
$\boxed{x^4 - 10x^3 + 11x^2 + 112x - 114 = f(x)}$

d) The y-intercept is when $x=0$

$= 0^4 - 10(0)^3 + 11(0)^2 + 112(0) - 114$

$= -114$

y-intercept $\boxed{(0,-114)}$



e) From Graphing Calculator

$\boxed{D: (-\infty, \infty)}$

$\boxed{R: [-218.45, \infty)}$

f). $f(x) \to \infty$ as $x \to -\infty$
$f(x) \to \infty$ as $x \to \infty$

g)

Relative Min		85.37
Absolute Min		-218.45
Relative Max		134.64

h) Intervals of Increase $(-1.49, 3.34) \cup (5.64, \infty)$
Intervals of Decrease $(-\infty, -1.49) \cup (3.34, 5.64)$

(2) Repeat problem #1 if the root $x = -3$ has a multiplicity of 2.

a) What are the x intercepts

$(-3, 0)$ and $(1, 0)$

b) $(x+3)(x+3)(x-1)(x-6+\sqrt{2}i)(x-6-\sqrt{2}i) = f(x)$

c) $(x+3)(x^4 - 10x^3 + 11x^2 + 112x - 114)$

$= x^5 - \cancel{10x^4} + \cancel{11x^3} + \cancel{112x^2} - \cancel{114x} + \cancel{3x^4} - \cancel{30x^3} + \cancel{33x^2} + \cancel{336x} - 342$

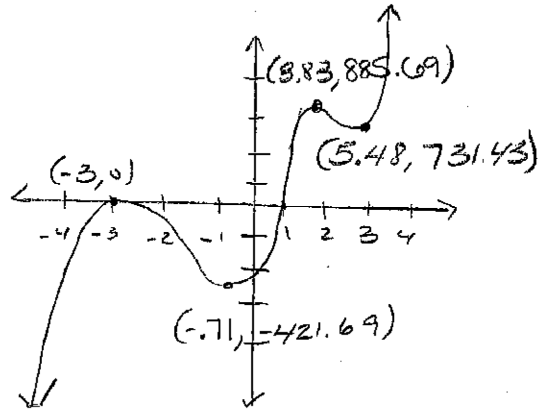
$\boxed{x^5 - 7x^4 - 19x^3 + 145x^2 + 222x - 342 = f(x)}$

d. y-intercept is when $x=0$

$0^5 - 7(0)^4 - 19(0)^3 + 145(0)^2 + 222(0) - 342$

$= -342$

$\boxed{(0, -342)}$



e. $\boxed{D: (-\infty, \infty)}$

$\boxed{R: (-\infty, \infty)}$

f. $\boxed{\begin{array}{l} f(x) \to -\infty \text{ as } x \to -\infty \\ f(x) \to \infty \text{ as } x \to \infty \end{array}}$

g. The are no absolute maximums or minimums.

$\boxed{\text{Local maximum } 0 \text{ \& } 885.69}$

$\boxed{\text{Local minimum } -421.69 \text{ \& } 731.43}$

h. $\boxed{\text{Intervals of Increase } (-\infty, -3) \cup (-.71, 3.83) \cup (5.48, \infty)}$

$\boxed{\text{Interval of Decrease } (-3, -.71) \cup (3.83, 5.48)}$

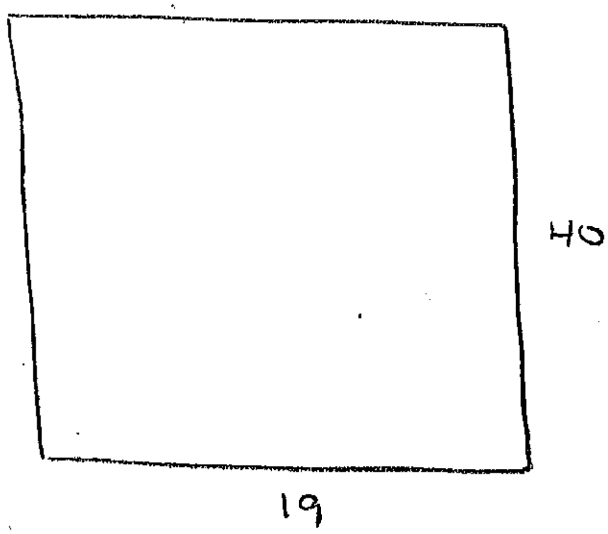
* Window

Xmin -10 ymin = -600

Xmax 10 ymax 1000

Xscl 2 yscl 200

1.



(a)

Window

x [-5, 15]

y [-10, 10]

$$V(x) = \tfrac{1}{2}(x)(19-2x)(40-5x)$$
$$V(2) = \tfrac{1}{2}(2)(19-2(2))(40-5(2))$$
$$V(2) = (19-4)(40-10)$$
$$V(2) = (15)(30)$$
$$V(2) = 450 \text{ in}^3$$

(b)

$$483.84 = \tfrac{1}{2}(x)(19-2x)(40-5x)$$
$$0 = \tfrac{1}{2}(x)(19-2x)(40-5x) - 483.84$$

using graphing calculator:

xint at (2.58, 0)

(3.2, 0)

(11.72, 0) X Not possible for dimensions of this box

Therefore: Volumn would be = 483.84 when

$x \approx 2.58$; $x = 3.2$

↑

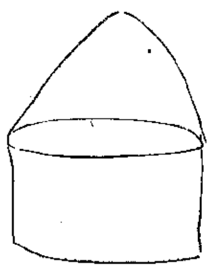
This is best value because it is exact.

2. $V = (14-2x)(32-2x)(x)$

From graphing calculator, volume is maximized when $x = 3.0358532$ in. The maximum volume is 624.07 in^3.

The dimensions of the box with maximum volume would be approximately 3.04 in by 7.93 in by 25.93 in.

3.



$V = \frac{1}{3}\pi r^3 + 25\pi r^2$

$2042 = \frac{1}{3}\pi r^3 + 25\pi r^2$

$0 = \frac{1}{3}\pi r^3 + 25\pi r^2 - 2042$

From graphing calculator

Zeros at -74.65008
-5.288865
4.9389468

Since the radius cannot be a negative length, the radius, to the nearest foot, that gives a volume of 2042 ft^3 is ≈ 5 ft.

4. $y = 0.025t^2 + 2t$

a) $800 = 0.025t^2 + 2t$
$0 = 0.025t^2 + 2t - 800$

From graphing calculator

Zeros at -223.303
$\boxed{143.30303}$

time cannot be negative

#4 Con't

Since t cannot be negative, $t = 143.3$ Sec.

$$\boxed{\text{It will take approximately } 143.3 \text{ Seconds to reach an altitude of } 800 \text{ ft.}}$$

b. Since t is in seconds, convert 4.5 minutes to seconds first.

$$4.5 \text{ min} \cdot \frac{60 \text{ sec}}{1 \text{ min}} = 270 \text{ sec.}$$

$$y = 0.025(270)^2 + 2(270)$$

$$y = 2,362.5$$

$$\boxed{\text{The altitude of the balloon after } 4.5 \text{ minutes is } 2,362.5 \text{ ft.}}$$

5. • x = # of Cameras
• $p = 100 - 8x^2$ (measured in millions) production function
• c = 25.00/camera (cost of a camera)
• production of 2.5 million cameras $\cdot \frac{\$25}{\text{camera}}$ = revenue

= 62.5 million dollars

If the company sells 2.5 million cameras, they will make 62.5 million dollars. For what other value of x will the company make 62.5 million dollars?

$$62.5 = (100 - 8x^2)(\$25/\text{camera})(x)$$

money made = (production)(cost)(# of Cameras)

$$f(x) = 2x^4 + 5x^3 - 21x^2 - 45$$

A. 1. The function is a polynomial, its degree is 4, and its leading coefficient is 2.

2. The y intercept is $(0, -45)$.

3. $f(x) \to \infty$ as $x \to -\infty$
$f(x) \to \infty$ as $x \to \infty$

4. $f(-x) = 2(-x)^4 + 5(-x)^3 - 21(-x)^2 - 45$

$$\boxed{f(-x) = 2x^4 - 5x^3 - 21x^2 - 45}$$

$$-f(x) = -1(2x^4 + 5x^3 - 21x^2 - 45)$$

$$\boxed{-f(x) = -2x^4 - 5x^3 + 21x^2 + 45}$$

If $f(-x) = f(x)$ then the function is even.

$f(-x)$ is not $= f(x)$, therefore the function is <u>not</u> <u>even</u>.

If, $-f(x) = f(-x)$ then the function is odd.

$-f(x)$ is not $= f(-x)$, therefore the function is not odd.

$\boxed{\text{The function is neither even nor is it odd}}$

B. 5) Zeros at -4.86 and 2.66

6) Domain $(-\infty, \infty)$

Range $[-217.02, \infty)$

7) The function would have to pass the horizontal line test to be one-to-one.

This function is not one to one.

* Does not pass the vertical and horizontal line test.