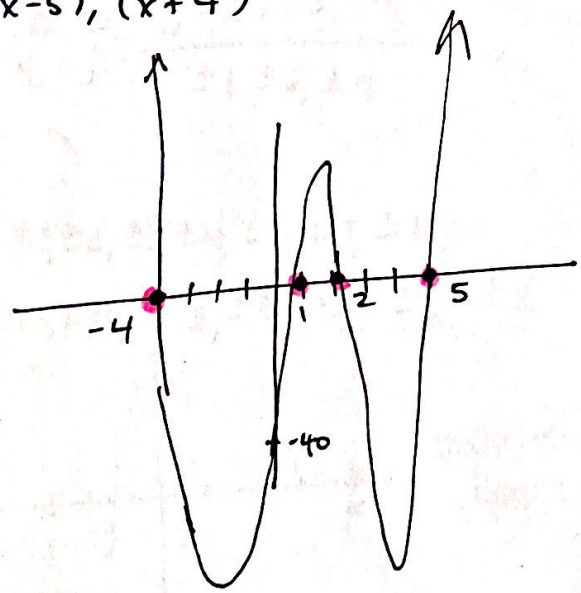
2.3b p.125
(55, 59, 85, 95, 107)

Factors

(55) $f(x) = x^4 - 4x^3 - 15x^2 + 58x - 40$

$(x-5), (x+4)$



(a)

5	1	-4	-15	58	-40
		5	5	-50	40
	1	1	-10	8	0 ✓

-4	1	1	-10	8
		-4	12	-8
	1	-3	2	0 ✓

$x^2 - 3x + 2$

(b) $(x-2)(x-1)$

$x-2=0$, $x-1=0$

$x=2$, $x=1$

(c) $(x-5)(x+4)(x-2)(x-1)$

(d) zeros $5, -4, 2, 1$

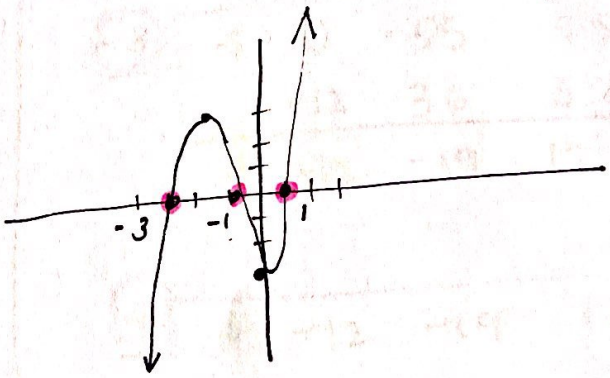
(59) $f(x) = x^3 + 3x^2 - x - 3$

q p

factors $p = \pm 1, \pm 3$

factors $q = \pm 1$

$\frac{p}{q} = \pm 1, \pm 3$



Test

1	1	3	-1	-3
		1	4	3
	1	4	3	0

$x^2 + 4x + 3$

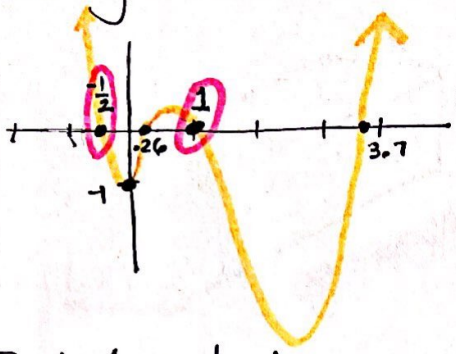
$(x+3)(x+1)$

$x+3=0$, $x+1=0$

$x=-3$, $x=-1$

Rational zeros $1, -1, -3$

(85.) $y = 2x^4 - 9x^3 + 5x^2 + 3x - 1$



peek at graph

Test 1 and $-\frac{1}{2}$

1	2	-9	5	3	-1
		2	-7	-2	1
	2	-7	-2	1	0

$-\frac{1}{2}$	2	-7	-2	1
		-1	4	-1
	2	-8	2	0

$2x^2 - 8x + 2 = 0$

$2(x^2 - 4x + 1) = 0$ $\quad a=1,\ b=-4,\ c=1$

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

$$= \frac{4 \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)} = \frac{4 \pm \sqrt{16-4}}{2}$$

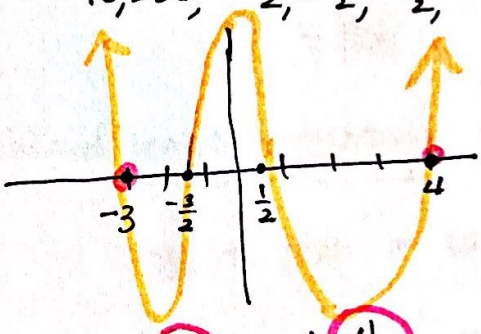
$$= \frac{4 \pm \sqrt{12}}{2} = \frac{4 \pm 2\sqrt{3}}{2} = 2 \pm \sqrt{3}$$

Real zeros $1, -\frac{1}{2}, 2 \pm \sqrt{3}$

(95) $f(x) = 4x^4 - 55x^2 - 45x + 36$ (a, p)

Find $\frac{p}{q} = \frac{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 9, \pm \frac{1}{2}, \pm 18, \pm 36}{\pm 1, \pm 2, \pm 4}$

possible factors $\frac{p}{q} = \pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 9, \pm 12, \pm 18, \pm 36, \pm \frac{1}{2}, \pm \frac{3}{2}, \pm \frac{9}{2}, \pm \frac{1}{4}, \pm \frac{3}{4}$



peek at graph

Test -3 and 4

-3	4	0	-55	-45	36
		-12	36	57	-36
	4	-12	-19	12	0

4	4	-12	-19	12
		16	16	-12
	4	4	-3	0

$4x^2 + 4x - 3 = 0$ $\quad a=4,\ b=4,\ c=-3$

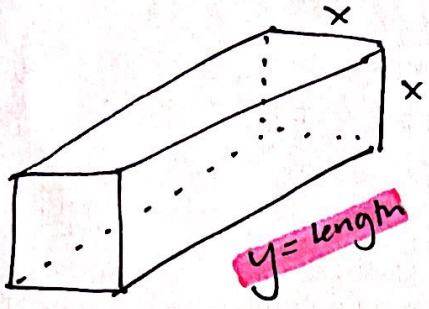
$$x = \frac{-4 \pm \sqrt{16 - 4(4)(-3)}}{2(4)}$$

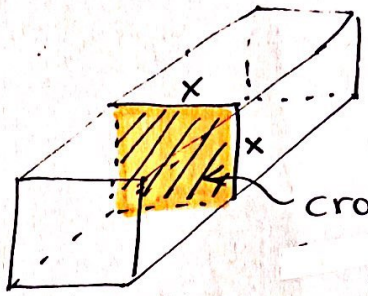
$$= \frac{-4 \pm \sqrt{16+48}}{8} = \frac{-4 \pm \sqrt{64}}{8}$$

$$= \frac{-4 \pm 8}{8} = \frac{1}{2} \text{ and } \frac{-3}{2}$$

Real zeros $-3, 4, \frac{1}{2}, -\frac{3}{2}$

(107)





cross section is girth

girth = perimeter of square

= 4x

(a.) $V = l \cdot w \cdot h$

$V = y \cdot x \cdot x$

$V = (120 - 4x)x^2$

$= 120x^2 - 4x^3$

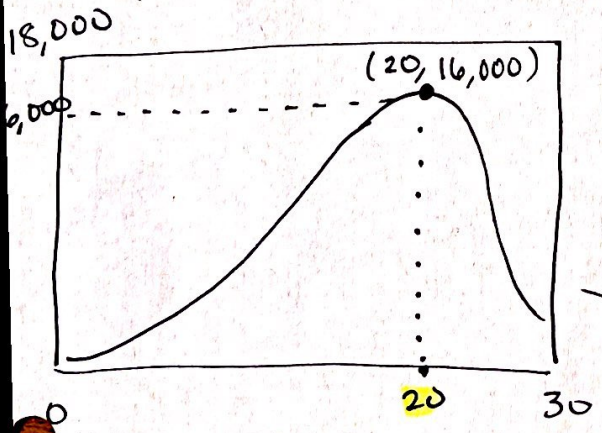
$V(x) = 4x^2(30 - x)$

max combined length + girth = 120

$y + 4x = 120$

$y = 120 - 4x$

(b) $X_{min} = 0$
$X_{max} = 30$
$Y_{min} = 0$
$Y_{max} = 18{,}000$



$x = 20$

$y = 120 - 4(x)$

$120 - 4(20) = 40$

Dimensions

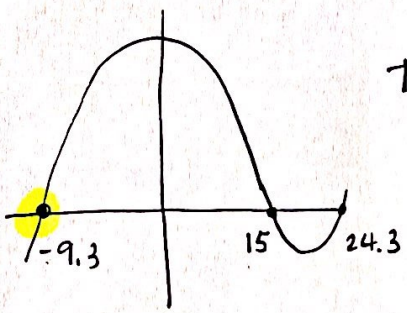
$x \cdot x \cdot y$

$20 \cdot 20 \cdot 40$

(c) $V = 13{,}500$

$120x^2 - 4x^3 = 13500$

$0 = 4x^3 - 120x^2 + 13500$



Test 15

$$15 \;\big|\; 4 \quad -120 \quad 0 \quad 13500$$
$$\qquad\quad 60 \quad -900 \quad -13500$$
$$\underline{\qquad 4 \quad -60 \quad -900 \quad 0}$$

now use Q.F.

$$x = \frac{60 \pm \sqrt{(-60)^2 - 4(4)(-900)}}{2(4)}$$

$$= \frac{60 \pm \sqrt{18000}}{8} = \frac{15 \pm 15\sqrt{5}}{2}$$

$\frac{15 - 15\sqrt{5}}{2}$ won't work! shows (-) Volume