Note Title

2.1 Polynomials

9/16/2012

The **degree** of a function is the exponent of the highest power of x in the equation.

Types of functions:

CONSTANT	$f(x) = 7$	Degree: 0	
LINEAR	$f(x) = 3x+1$	Degree: 1	
QUADRATIC	$f(x) = 2x^2+x-3$	Degree: 2	
CUBIC	$f(x) = x^3+7$	Degree: 3	
QUARTIC	$f(x) = x^4+x^2$	Degree: 4	$y = x^3y + x^2$
QUINTIC	$f(x) = x^5+3x^4$	Degree: 5	$y = x^2y^3 + x$

Not Polynomial Functions:

$y = \sqrt{x+6} \rightarrow \sqrt{x}$ $y = \sqrt{5}\,x$ ✓

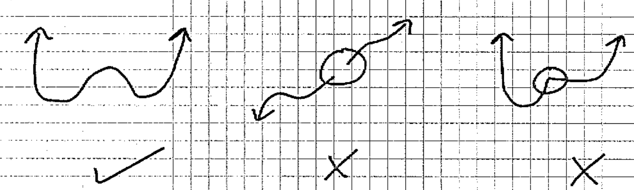
$y = \dfrac{4x^2-7}{3x} \rightarrow \dfrac{1}{3x}$ $y = \dfrac{2x+7}{3}$ ✓

$y = 5x^2 + 2^x \rightarrow 2^x$

$y = \sqrt{-2}\,x$

Polynomial functions are always continuous

- no breaks or sharp corners
- can draw w/o lifting pencil

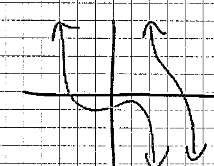


Odd Degree Functions - linear, cubic...

Positive Leading Coefficient — Negative Leading Coefficient

- rises to the right ← END BEHAVIOUR → - falls to the right

Ex $y = x+2$ OR $y = 3x^3 - 5x$ Ex $y = -3x$, $y = -2x^3$



III → I
"starts down and ends up"

II → IV
"starts up and ends down"

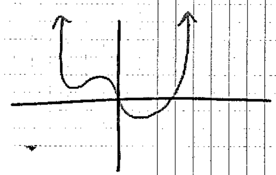
Even Degree Functions · quadratic, quartic

END BEHAVIOUR

Positive Leading Coefficient

- opens up / rises left and right

Ex $y = 3x^2 - 1$, $y = 5x^4 - x^3$



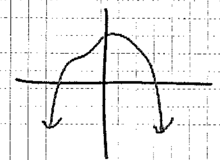
II → I

"starts up and ends up"

Negative Leading Coefficient

- opens down / falls left and right

Ex $y = -x^2$, $y = -3x^4 + 7$



III → IV

"starts down and ends down"

To determine the y-intercept → $x = 0$

Ex $y = 3(x-2)^2$

$y = 3(-2)^2$

$y = 12$

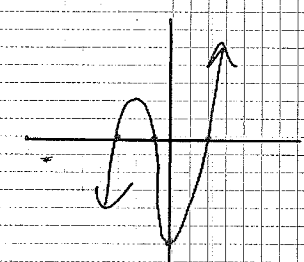
$f(x) = (x+2)(2x-1)$

$f(0) = (2)(-1)$

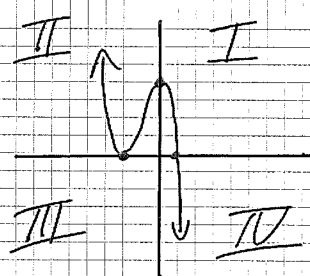
$f(0) = -2$

① Graph: (Determine y-intercept, zeros)

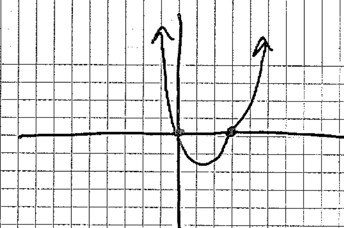
a) $y = (x+1)(x-2)(x+3)$



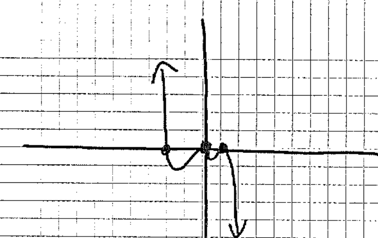
b) $y = -(x-1)(x+2)^2$



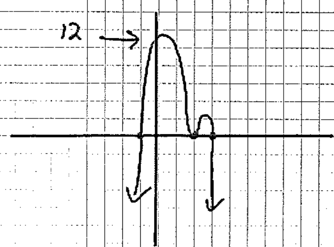
c) $y = x(x-3)^3$



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



e.) $y = -(x-2)^2(x+1)(x-3)$



y int: $-(-2)^2(1)(-3)$

$-(4)(-3)$

$+12$

(2) Determine the zeros

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

$y = -3x^2(x^2-1)$

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

$x = 0$ "of multiplicity 2"

$x = +1, -1$

b) $y = x^3 - 3x^2 - 4x + 12$

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

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

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

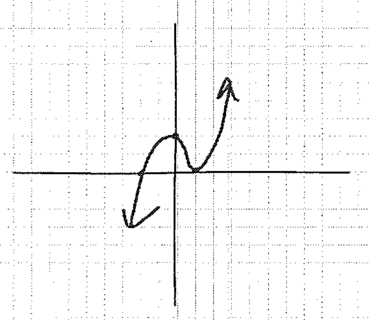
$\boxed{x = \pm 2, 3}$

Pg 73 #2-4, 5a), 6, 7, 9

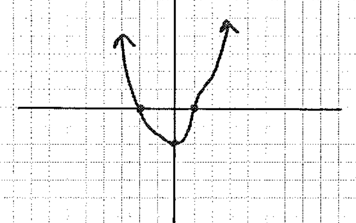
2.2 Graphing Polynomial Functions

① Graph

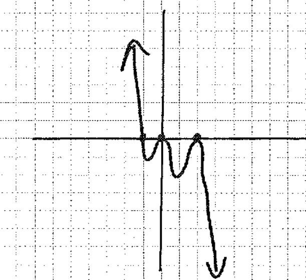
a) $y=(x+2)(x-1)^2$



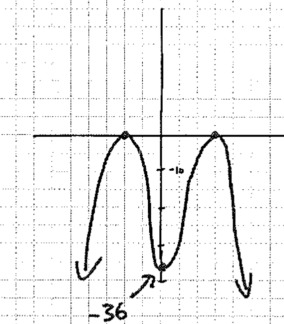
b) $y=(x-1)^3(x+2)$



c) $y=-x^2(x-2)^3(x+1)$



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



② Determine the equation of each polynomial

a) zeros: -2, 1, 1, 3 and y-intercept 5

$y=a(x+2)(x-1)^2(x-3)$ $\quad (\underset{x}{0},\underset{y}{5})$

$5=a(2)(-1)^2(-3)$

$5=a(2)(1)(-3)$

$5=a(-6)$

$\frac{5}{-6}=a$

$$\boxed{y=-\frac{5}{6}(x+2)(x-1)^2(x-3)}$$

b) zeros: 0, 4, and -1 of multiplicity 3 and $f(-2)=3$

$y=ax(x-4)(x+1)^3$ $\quad (\underset{x}{-2},\underset{y}{3})$

$3=a(-2)(-6)(-1)^3$

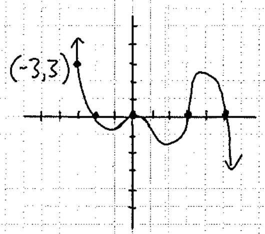
$3=a(12)(-1)$

$3=a(-12)$

$\frac{3}{-12}=a=-\frac{1}{4}$

$$\boxed{y=-\frac{1}{4}x(x-4)(x+1)^3}$$

c)



$y = a(x+2)(x)^2(x-3)(x-5)$

$3 = a(-1)(9)(-6)(-8)$

$3 = a(-432)$

$a = -\frac{3}{432} = -\frac{1}{144}$

$$\boxed{y = -\frac{1}{144}(x+2)(x)^2(x-3)(x-5)}$$

d) degree is 4, has $-\frac{1}{2}$ as a root of multiplicity 3, and $2x^2 - x - 1$ is a factor.

root of $-\frac{1}{2} \rightarrow x = -\frac{1}{2} \rightarrow (2x+1)^3$

$2x^2 - 2x + x - 1$

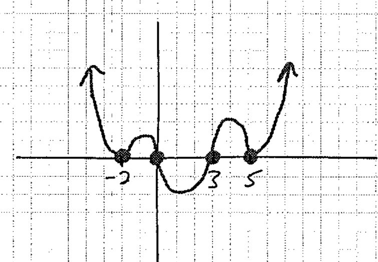
$2x(x-1) + 1(x-1)$

$(2x+1)(x-1)$

$$\boxed{y = (2x+1)^3(x-1)}$$

③ Sketch the graph of the polynomial function of lowest degree:

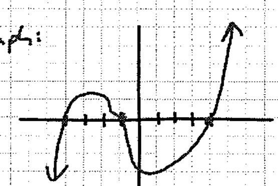
Value of $f(x)$	+	+	−	+	+
zeros	−2	0	3	5	



④ Find all values of x such that: a) $f(x) \geq 0$:

$f(x) = (x+4)(x+1)^3(x-4)$

Graph:



$$\boxed{-4 \leq x \leq -1,\ x \geq 4}$$

b) $f(x) < 0$

$$\boxed{x < -4,\ -1 < x < 4}$$

Note Title 9/19/2012

2.3 Division of Polynomials - Long Division

Recall: Long Division

$784 \div 17 = ?$

DIVISOR → 17, QUOTIENT → 46, DIVIDEND → 784

$$\begin{array}{r} 46 \\ 17\overline{)784} \\ -68\downarrow \\ \hline 104 \\ -102 \\ \hline 2 \end{array}$$

2 ← REMAINDER

① $(3x^2+8x+11) \div (x+2)$

$$\begin{array}{r} 3x+2 \\ x+2\overline{)3x^2+8x+11} \\ -(3x^2+6x)\downarrow \\ \hline 2x+11 \\ -(2x+4) \\ \hline 7 \end{array}$$

* Two ways to write answer:

$\frac{\text{Dividend}}{\text{Divisor}} = \text{Quotient} + \frac{\text{Remainder}}{\text{Divisor}}$ OR $\text{Dividend} = (\text{Quotient})(\text{Divisor}) + \text{Remainder}$

$\frac{3x^2+8x+11}{x+2} = 3x+2+\frac{7}{x+2}$ OR $3x^2+8x+11 = (3x+2)(x+2)+7$

② Divide x^3+2x^2-5x-6 by $x-2$

$$\begin{array}{r} x^2+4x+3 \\ x-2\overline{)x^3+2x^2-5x-6} \\ -(x^3-2x^2)\downarrow \\ \hline 4x^2-5x \\ -(4x^2-8x)\downarrow \\ \hline 3x-6 \\ -(3x-6) \\ \hline 0 \end{array}$$

$\frac{x^3+2x^2-5x-6}{x-2} = x^2+4x+3$

OR

$x^3+2x^2-5x-6 = (x^2+4x+3)(x-2)$

$$\frac{x^3+2x^2-5x-6}{x-2} = x^2+4x+3$$

OR

$$x^3+2x^2-5x-6 = (x^2+4x+3)(x-2)$$

③ $(6x^3+2x-1)\div(2x-4)$

$$\begin{array}{r} 3x^2+6x+13 \\ 2x-4 \overline{\big) 6x^3+0x^2+2x-1} \\ -(6x^3-12x^2) \downarrow \quad\quad \\ \hline 12x^2+2x \quad\quad \\ -(12x^2-24x) \downarrow \\ \hline 26x-1 \\ -(26x-52) \\ \hline 51 \end{array}$$

$$\frac{6x^3+2x-1}{2x-4} = 3x^2+6x+13 + \frac{51}{2x-4} \quad \text{OR} \quad 6x^3+2x-1 = (3x^2+6x+13)(2x-4)+51$$

④ $(4x^3+5x-3)\div(x+2)$

$$\begin{array}{r} 4x^2-8x+21 \\ x+2 \overline{\big) 4x^3+0x^2+5x-3} \\ -(4x^3+8x^2) \downarrow \quad\quad \\ \hline -8x^2+5x \quad\quad \\ -(-8x^2-16x) \downarrow \\ \hline 21x-3 \\ -(21x+42) \\ \hline -45 \end{array}$$

$$\frac{4x^3+5x-3}{x+2} = 4x^2-8x+21 - \frac{45}{x+2}$$

OR

$$4x^3+5x-3 = (4x^2-8x+21)(x+2)-45$$

5 $(2x^3+4x^2-2x+6) \div (2x^2+1)$

$$\begin{array}{r} x+2 \\ 2x^2+0x+1 \overline{) 2x^3+4x^2-2x+6} \\ -(2x^3+0x^2+x) \downarrow \\ 4x^2-3x+6 \\ -(4x^2+0x+2) \\ \hline -3x+4 \end{array}$$

pg 89

#1 (a, c, e)

$$\frac{2x^3+4x^2-2x+6}{2x^2+1} = x+2 - \frac{3x+4}{2x^2+1}$$ OR $$2x^3+4x^2-2x+6 = (x+2)(2x^2+1) - 3x+4$$

Note Title

2.3 Division of Polynomials - Synthetic Division

9/20/2012

Faster method of division → only work with the coefficients

Ex Divide $3x^2+8x+11$ by $x+2$

$$\begin{array}{r|rrr} -2 & 3 & 8 & 11 \\ & \downarrow & -6 & -4 \\ \hline & 3 & 2 & \boxed{7} \end{array}$$

$3x+2$ R7

$$\frac{3x^2+8x+11}{x+2} = 3x+2+\frac{7}{x+2}$$

① Divide

a) $x^3-7x+4x^2-10 \div x+5$ * Re-arrange in descending order

$$\begin{array}{r|rrrr} -5 & 1 & 4 & -7 & -10 \\ & \downarrow & -5 & 5 & 10 \\ \hline & 1 & -1 & -2 & \boxed{0} \end{array}$$

x^2-x-2 R0

$$\frac{x^3+4x^2-7x-10}{x+5} = x^2-x-2+\frac{0}{x+5}$$

$$x^3+4x^2-7x-10 = (x^2-x-2)(x+5)$$

b) $x^3-7x+6 \div x-3$

$$\begin{array}{r|rrrr} 3 & 1 & 0 & -7 & 6 \\ & \downarrow & 3 & 9 & 6 \\ \hline & 1 & 3 & 2 & \boxed{12} \end{array}$$

$$\frac{x^3-7x+6}{x-3} = x^2+3x+2+\frac{12}{x-3}$$ OR

$$x^3-7x+6 = (x^2+3x+2)(x-3)+12$$

c) $4x^3-15x+2 \div x-3$

$$\begin{array}{r|rrrr} 3 & 4 & 0 & -15 & 2 \\ & \downarrow & 12 & 36 & 63 \\ \hline & 4 & 12 & 21 & \boxed{65} \end{array}$$

$$\frac{4x^3-15x+2}{x-3} = 4x^2+12x+21+\frac{65}{x-3}$$

OR

$$4x^3-15x+2 = (4x^2+12x+21)(x-3)+65$$

d) $4x^4-8x^3+11x^2+1$ by $2x-1$

$$\begin{array}{c|ccccc} \frac{1}{2} & 4 & -8 & 11 & 0 & 1 \\ & \downarrow & 2 & -3 & 4 & 2 \\ \hline & 4 & -6 & 8 & 4 & \boxed{3} \end{array}$$

* The coefficient of x must be 1

$2x-1=0$

$2x=1$

$x=\frac{1}{2}$

$$\frac{4x^4-8x^3+11x^2+1}{2x-1} = 2x^3-3x^2+4x+2+\frac{3}{2x-1}$$

$\div 2$

OR

$$4x^4-8x^3+11x^2+1 = (2x^3-3x^2+4x+2)(2x-1)+3$$

(2) When x^3+kx+1 is divided by $x-2$ the remainder is -3. Determine k.

$$\begin{array}{c|cccc} 2 & 1 & 0 & k & 1 \\ & \downarrow & 2 & 4 & 2k+8 \\ \hline & 1 & 2 & k+4 & \boxed{-3} \end{array}$$

$\therefore\ 1+2k+8=-3$

$2k=-12$

$\boxed{k=-6}$

Pg 90 #2 (a, c, g)

3 (a, c, d)

4 (c)

Note Title

2.4 The Remainder + Factor Theorems

9/23/2012

① a) Determine the remainder given $(x^3+4x^2+x-2) \div (x-2)$

$$\begin{array}{c|cccc} 2 & 1 & 4 & 1 & -2 \\ & \downarrow & 2 & 12 & 26 \\ \hline & 1 & 6 & 13 & \boxed{24} \end{array}$$

Remainder = 24

b) What is the value of $f(2)$ if $f(x) = x^3+4x^2+x-2$?

$f(2) = 2^3+4(2)^2+2-2$

$= 8+16$

$= \underline{\underline{24}}$ Same as Remainder

* When a polynomial $P(x)$ is divided by $x-a$, the remainder is $P(a)$.

"Remainder Theorem"

② Determine the remainder when x^3-4x^2+5x+1 is divided by:

a) $x-2$

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

$= 8-16+10+1$

$= \boxed{3}$

b) $x+1$

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

$= -1-4-5+1$

$= \boxed{-9}$

③ When $x^3+3x^2+cx+10$ is divided by $x-2$, the remainder is 6. Determine c.

$2^3+3(2)^2+c(2)+10 = 6$

$8+12+2c+10 = 6$

$2c = 6-30$

$2c = -24$

$\boxed{c = -12}$

When a polynomial $P(x)$ is divided by $x-a$ and the remainder of $P(a)=0$, $x-a$ is a factor of $P(x)$.

"FACTOR THEOREM"

④ Given $f(x)=x^3-3x^2-6x+8$, which is a factor of $f(x)$?

a) $x+3$

$f(-3)=(-3)^3-3(-3)^2-6(-3)+8$

$=-27-27+18+8$

$=-28$

$x+3$ is NOT a factor

b) $x-4$

$f(4)=4^3-3(4)^2-6(4)+8$

$=64-48-24+8$

$=0$ ✓

$x-4$ is a factor

RATIONAL ROOT THEOREM

Possible Factors $=\dfrac{\text{Factors of Constant Term}}{\text{Factors of Leading Coefficient}}$

Ex $3x^3-2x^2+x-4$

FACTOR OPTIONS: $\dfrac{\pm1,\pm2,\pm4}{\pm1,\pm3}=\boxed{\pm1,\pm2,\pm4,\ \pm\frac{1}{3},\pm\frac{2}{3},\pm\frac{4}{3}}$

⑤ Factor using the Factor / Rational Root Theorem

a) $f(x)=2x^3+7x^2+2x-3$

Options $=\dfrac{\text{Factors of }3}{\text{Factors of }2}=\dfrac{\pm1,\pm3}{\pm1,\pm2}=\pm1,\pm3,\pm\frac{1}{2},\pm\frac{3}{2}$

$2x^2+5x-3$

$2x^2+6x-x-3$

$2x(x+3)-1(x+3)$

$(2x-1)(x+3)$

$f(-1)=0$ $\therefore$ $(x+1)$ is a factor

$$\begin{array}{r|rrrr} -1 & 2 & 7 & 2 & -3 \\ & \downarrow & -2 & -5 & 3 \\ \hline & 2 & 5 & -3 & 0 \end{array}$$

$(x+1)(2x^2+5x-3)$

$\boxed{(x+1)(2x-1)(x+3)}$

b) $f(x)=4x^3-8x^2-x+2$

Options: $\dfrac{\pm1,\pm2}{\pm1,\pm2,\pm4}=\pm1,\pm2,\pm\frac{1}{2},\pm\frac{1}{4}$

$f(2)=0$ $\therefore$ $x-2$ is a factor

$$\begin{array}{r|rrrr} 2 & 4 & -8 & -1 & 2 \\ & \downarrow & 8 & 0 & -2 \\ \hline & 4 & 0 & -1 & 0 \end{array}$$

$4x^2-1$

$\boxed{(2x-1)(2x+1)(x-2)}$

R_x 97

#1, 2(a), 3b), 4(a, c, e), 5e)

② g) $1^4 + k(1)^3 - m(1) + 15 = 0$

$1 + k - m + 15 = 0$

$k - m = -16$

$\boxed{k + 16 = m}$ * ①

$6 + 16 = m$

$\boxed{m = 22}$

$(-3)^4 + k(-3)^3 - m(-3) + 15 = 0$

$81 - 27k + 3m + 15 = 0$

$-27k + 3m = -96$

$\div 3$ $\boxed{-9k + m = -32}$ * ②

sub ① into ②

$-9k + k + 16 = -32$

$-8k = -48$

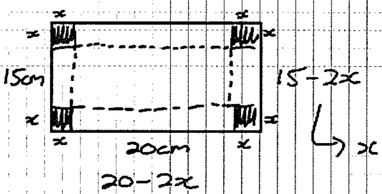
$\boxed{k = 6}$

Note Title

2.5 POLYNOMIAL APPLICATIONS

9/24/2012

① An open top rectangular box is constructed by cutting a square of length x from each corner of a 20cm x 15cm rectangle, and then folding up the sides. What is the size of square cut out if the volume is $250 cm^3$? ($x \geq 2cm$) Dimensions?



$\hookrightarrow x < 7.5$

$V = (20-2x)(15-2x)(x)$

$250 = (20-2x)(15-2x)(x)$

$V = \text{length} \times \text{width} \times \text{height}$

$250 = (20-2x)(15-2x)(x)$

$250 = (300 - 70x + 4x^2)(x)$

$250 = 300x - 70x^2 + 4x^3$

$0 = 4x^3 - 70x^2 + 300x - 250 \quad (\div 2)$

$0 = 2x^3 - 35x^2 + 150x - 125$

* No ±

Options: $\dfrac{1, 5, 25, 125}{1, 2} \rightarrow \underbrace{5, \frac{5}{2}}_{x \geq 2,\ x < 7.5}$

Try 5:

$$\begin{array}{c|cccc} 5 & 2 & -35 & 150 & -125 \\ & \downarrow & 10 & -125 & 125 \\ \hline & 2 & -25 & 25 & 0 \end{array} \checkmark$$

Solve $2x^2 - 25x + 25$ using quadratic formula

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

$x = \dfrac{25 \pm \sqrt{625 - 4(2)(25)}}{4} = \dfrac{25 \pm \sqrt{425}}{4} = \dfrac{25 \pm 20.62}{4}$

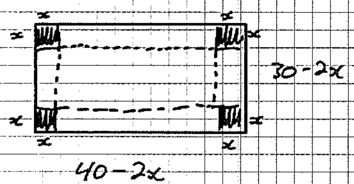
$x = 11.4cm$ too big ∴ reject

$x = 1.10cm$ too small ∴ reject

∴ $\boxed{\begin{array}{l} \text{Square is } 5cm \times 5cm \\ \text{Dimensions } 10cm \times 5cm \times 5cm \end{array}}$

$\uparrow 20-2(x) \quad \uparrow 15-2(x) \quad \uparrow x$

(2) Box: 40cm x 30cm piece of cardboard. Dimensions if volume is $3000cm^3$?



$(30-2x)(40-2x)(x) = 3000$

$(1200 - 140x + 4x^2)(x) = 3000$

$4x^3 - 140x^2 + 1200x - 3000 = 0 \quad \div 4$

$x^3 - 35x^2 + 300x - 750 = 0$

* $x > 0$

$x < 15$

Options: 1, 2, 3, 5, 6, 10

5	1	-35	300	-750
	↓	5	-150	750
	1	-30	150	0

$x^2 - 30x + 150$

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

$$x = \frac{30 \pm \sqrt{30^2-4(1)(150)}}{2} = \frac{30 \pm \sqrt{300}}{2}$$

$x = 23.66 \,/\, 6.34$ ✓

too big

* < 15

5cm x 20cm x 30cm

6.34cm x 17.32cm x 27.32cm

x $30-2x$ $40-2x$

pg 102 #1, 5

+ Review: pg 104

#1-50

* Not #13, 16, 30, 36

Note Title

2.6 Applications

2013-03-27

① The sum of 2 numbers is 12. The sum of their reciprocals is $\frac{3}{8}$. What are the numbers?

Let x be 1st #
Let $12-x$ be 2nd #

$$\frac{1}{x} + \frac{1}{12-x} = \frac{3}{8} \qquad LCD = x(12-x)(8)$$

$$8(12-x) + 8x = 3x(12-x)$$

$$96 - \cancel{8x} + \cancel{8x} = 36x - 3x^2$$

$$3x^2 - 36x + 96 = 0 \quad \div 3$$

$$x^2 - 12x + 32 = 0$$

$$(x-4)(x-8) = 0$$

$x = 4$ $\quad$ $x = 8$
4 and $12-4$ $\quad$ 8 and $12-8$
4 & 8 $\quad$ 8 + 4

$\boxed{\therefore \text{The numbers are 4 and 8}}$

* If $x = 4$ $\quad x = 9$
#s: 4, 8 AND 9, 3

② The sum of the reciprocals of two consecutive even integers is $\frac{5}{12}$. What are the integers?

Let x be the first integer
Let $x+2$ be the 2nd integer

$$\frac{1}{x} + \frac{1}{x+2} = \frac{5}{12} \qquad LCD = x(x+2)(12)$$

$$12(x+2) + x(12) = 5x(x+2)$$

$$12x + 24 + 12x = 5x^2 + 10x$$

$$0 = 5x^2 - 14x - 24$$

$$0 = 5x^2 - 20x + 6x - 24$$

$$0 = 5x(x-4) + 6(x-4)$$

$$0 = (5x+6)(x-4)$$

$\cancel{x = -\frac{6}{5}}$ $\qquad$ $x = 4$

Not an even integer

$\boxed{\text{The integers are 4 and 6}}$

Pg 91
#1 (a-e)

Review
Pg 94
#1-6, 8

* Consecutive Integers
  $x, x+1$
* Consecutive Odd/Even Integers
  $x, x+2$
* Difference of 10
  $x, x-10$
* Sum of 13
  $x, 13-x$.

Note Title 9/27/2012

Ch 2 Review

① Given the graph of $f(x) = ax^3 + bx^2 + cx + d$ what must be true about a and d?

A) $a > 0,\ d > 0$

B) $a > 0,\ d < 0$

C) $a < 0,\ d > 0$

D) $a < 0,\ d < 0$

B

② What is the remainder when $x^{32} - 1$ is divided by $x + 1$?

$(-1)^{32} - 1$

$1 - 1$

$\boxed{0}$

③ When $x^3 - x^2 + kx + 5$ is divided by $x + 2$, the remainder is 1. Find the value of k.

$(-2)^3 - (-2)^2 + k(-2) + 5 = 1$

$-8 - 4 - 2k + 5 = 1$

$-2k = 8$

$\boxed{k = -4}$

OR

$$\begin{array}{r|rrrr} -2 & 1 & -1 & k & 5 \\ & \downarrow & -2 & 6 & -2k-12 \\ \hline & 1 & -3 & k+6 & \boxed{-2k-7} \end{array}$$

$-2k - 7 = 1$

$-2k = 8$

$\boxed{k = -4}$

④ $(x^4 + 3x^3 + 5x^2 + 21x - 13) \div (x^2 + 3x - 2)$ using long division.

$$\begin{array}{r} x^2 + 7 \\ x^2 + 3x - 2 \,\big)\, \overline{x^4 + 3x^3 + 5x^2 + 21x - 13} \\ -\underline{(x^4 + 3x^3 - 2x^2)} \downarrow \quad \downarrow \\ 7x^2 + 21x - 13 \\ -\underline{(7x^2 + 21x - 14)} \\ 1 \end{array}$$

$$\frac{x^4 + 3x^3 + 5x^2 + 21x - 13}{x^2 + 3x - 2} = x^2 + 7 + \frac{1}{x^2 + 3x - 2}$$

OR

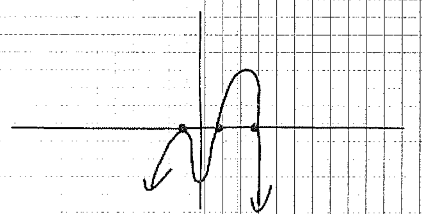
$$x^4 + 3x^3 + 5x^2 + 21x - 13 = (x^2 + 7)(x^2 + 3x - 2) + 1$$

⑤ Given $f(x) = -(x+1)^2(x-1)(x-3)$, for what values of x is

a) $f(x) < 0$?

b) $f(x) \geq 0$

$\boxed{x = -1,\ 1 \leq x \leq 3}$



$\boxed{x < -1,\ -1 < x < 1,\ x > 3}$

⑥ Given $5x^4 + 12x^3 - 101x^2 + 48x + 36$

a) Factor and b) Solve

Options: $\pm 1, \pm 2, \pm 3 \ldots$

$$\begin{array}{r|rrrrr} 1 & 5 & 12 & -101 & 48 & 36 \\ & \downarrow & 5 & 17 & -84 & -36 \\ \hline & 5 & 17 & -84 & -36 & 0 \end{array}$$

$5x^3 + 17x^2 - 84x - 36$

$$\begin{array}{r|rrrr} 3 & 5 & 17 & -84 & -36 \\ & \downarrow & 15 & 96 & 36 \\ \hline & 5 & 32 & 12 & 0 \end{array}$$

$5x^2 + 32x + 12$

$5x^2 + 30x + 2x + 12$

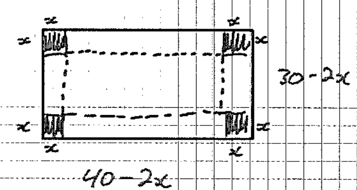
$5x(x+6) + 2(x+6)$

$(5x+2)(x+6)$

a) $(x-1)(x-3)(5x+2)(x+6)$

b) $x = 1, 3, -\frac{2}{5}, -6$

⑦ Box: 40cm x 30cm piece of cardboard. Dimensions if volume is $3000cm^3$?



$(30-2x)(40-2x)(x) = 3000$

$(1200 - 140x + 4x^2)(x) = 3000$

$4x^3 - 140x^2 + 1200x - 3000 = 0$

$x^3 - 35x^2 + 300x - 750 = 0$

$$\begin{array}{r|rrrr} 5 & 1 & -35 & 300 & -750 \\ & \downarrow & 5 & -150 & 750 \\ \hline & 1 & -30 & 150 & 0 \end{array}$$

$x^2 - 30x + 150$

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

$x = \frac{30 \pm \sqrt{30^2 - 4(1)(150)}}{2} = \frac{30 \pm \sqrt{300}}{2}$

$x = 23.66 \,/\, 6.34$ ✓

too big

$x < 15$

5cm x 20cm x 30cm

6.34cm x 17.32cm x 27.32cm

$x \quad 30-2x \quad 40-2x$

Pg 104

#1-50

* Not #13, 16, 30, 36