Revised 11, 21, 06

MA180 Review Packet
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#1)

a) $f(x)=\dfrac{\sqrt{7x+3}}{x-1}$ $\quad \boxed{\{x \mid x \geq -\frac{3}{7}, x \neq 1\}}$

b) $g(x)=\dfrac{2}{\sqrt{4-x^2}}$ $\quad \{x \mid -2 < x < 2\}$

c) $h(x)=\dfrac{x^2+4x+5}{2x^2+13x-7}=\dfrac{x^2+4x+5}{(2x-1)(x+7)}$ $\quad \{x \mid x \neq \frac{1}{2}, x \neq -7\}$

d) $K(x)=\ln\left(\dfrac{3x-2}{x+4}\right)$ $\quad \dfrac{3x-2}{x+4}>0$ $\quad + \; -4 \; - \; \frac{2}{3} \; +$

Domain: $(-\infty,-4) \cup (\frac{2}{3}, \infty)$

e) Domain: $\boxed{(-\infty,-2) \cup (-2, 5]}$

f) $m(x)=\dfrac{\sin x}{e^x}$ $\quad e^x>0 \Rightarrow$ Domain $\boxed{(-\infty, \infty)}$

#2)

a) $(0,2)$ is the x-intercept

b) $(0,-1)$ is the y-intercept

c) at $(-1,1)$ & $(4,6)$ these y_1 and y_2 are equal.

#3)

a) $Q=(-1,-3)$ $\quad P=(2,6)$

b) $f(1)=-1$

c) $f(0)=-2$

d) at $x=2$ $f(x)=6$

e) $f(x)=0$ at $x \cong 1.25$

#4) $\dfrac{f(x+h)-f(x)}{h}$ $\quad f(x)=3x^2+5x-8$

$$f(x+h)=3(x+h)^2+5(x+h)-8$$
$$=3(x^2+2xh+h^2)+5x+5h-8$$
$$=3x^2+6xh+3h^2+5x+5h-8$$

$$\frac{f(x+h)-f(x)}{h}=\frac{3x^2+6xh+3h^2+5x+5h-8-(3x^2+5x-8)}{h}$$

$$=\frac{6xh+3h^2+5h}{h}=\frac{\cancel{h}(6x+3h+5)}{\cancel{h}}=\boxed{6x+3h+5}$$

#5) $f(x)=35x^4-25x^2$

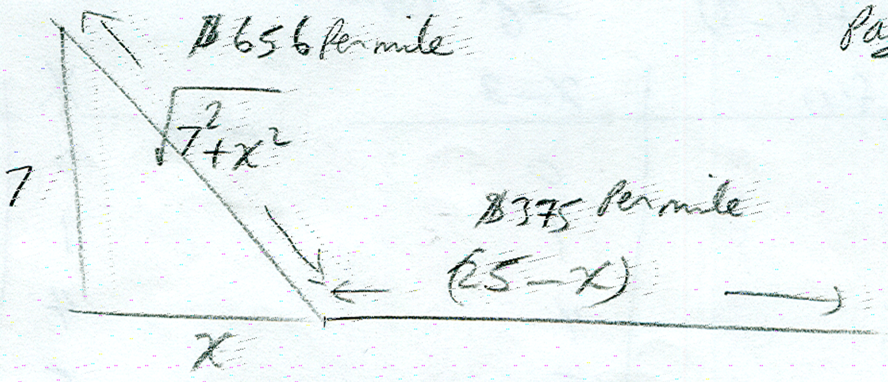
local Max at $(0,0)$

local Min at $(-0.598,-4.464)$ & $(0.598,-4.464)$

Decreasing $(-\infty,-0.598)\cup(0,0.598)$

Increasing $(-0.598,0)\cup(0.598,\infty)$

#6



$$C(x) = 656\left(\sqrt{49+x^2}\right) + 375(25-x)$$

$$C(x) = \left(656\sqrt{49+x^2}\right) + 9375 - 375x$$

$\therefore$ Minimum Cost = $13142.74

#8 $f(-x) \neq f(x)$ Not even
$f(-x) \neq -f(x)$ Not odd
$\Rightarrow$ Neither

(b) x intercepts are $(2,0)$ & $(5,0)$

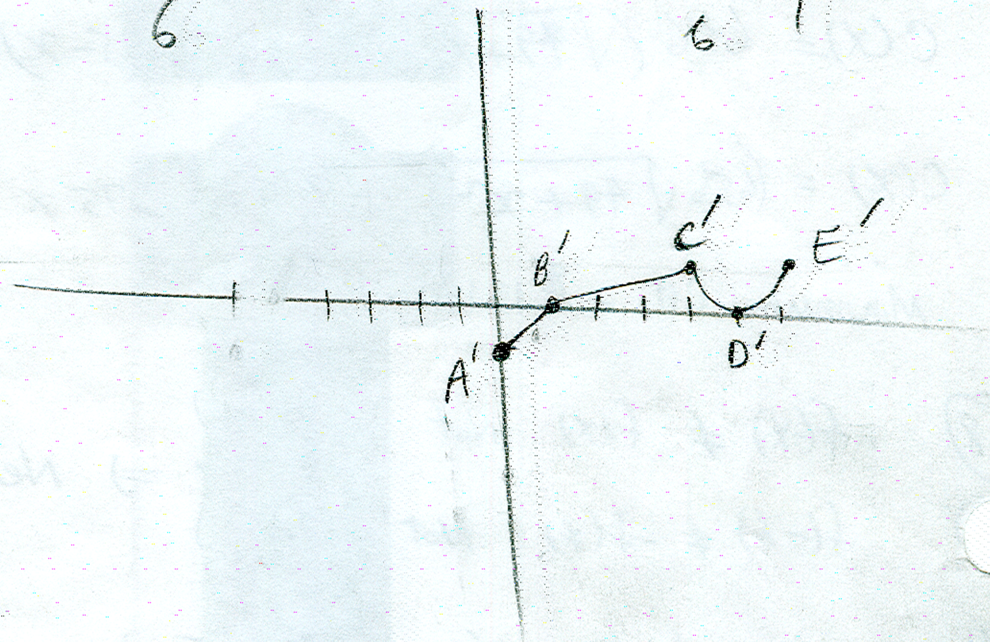
(c) y intercept is $(0,3)$

#9 (a) $-\frac{1}{2}f(x-3)$ shift Right 3

x	y	$-\frac{1}{2}f(x)$	$x-3$
-3	2	-1	0
-2	0	0	1
1	-2	1	4
2	0	0	5
3	-2	1	6

$\rightarrow$

X	y
0	-1
1	0
4	1
5	0
6	1



(b) $-f(x)+2$

#10 (a) $(f+g)(3) = 2 + -4 = -2$

(b) $(f-g)(1) = 2 - -2 = 4$

(c) $\left(\frac{f}{g}\right)(2) = \frac{0}{0} =$ undefined

(d) $(fg)(4) = f(4) * g(4) = 4 * -3 = -12$

(e) $(f \circ g)(2) = f(g(2)) = f(0) = 4$

(f) $(g \circ f)(2) = g(f(2)) = g(0) = 1$

#11 If $f(x) = x^2+1$ $\quad g(x) = \sqrt{x-5}$

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(a) $f(g(f(3))) = f(g(10)) = f(\sqrt{5}) = 5+1 = 6$

Domain

(b) $f(g(x)) = \left(\sqrt{x-5}\right)^2 + 1 = x-5+1 = x-4$ $\quad x \geq 5$

(c) $(g \circ f)(x) = \sqrt{(x^2+1)-5} = \sqrt{x^2-4}$; $x^2-4 \geq 0$

$x \leq -2$ or $x \geq 2$

(d) $g^{-1}(x)$

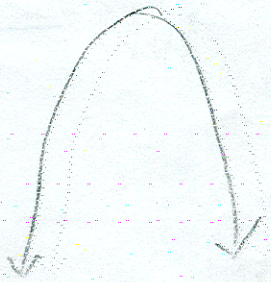
$y = \sqrt{x-5}$

$x = \sqrt{y-5} \Rightarrow x^2 = y-5$ $\quad y = x^2+5$

Domain : $x \mid x \geq 0$

(e) $(f \circ g^{-1})(2) = f(9) = 9^2+1 = 82$

#12 $f(x) = ax^{88}$; $a<0$



a) Symmetric w.r.t y-axis

b) Domain all Reals

c) Range $y \leq 0$

(d) $x \to \infty$ $\quad f(x) \to -\infty$ $\quad$ Right end

$x \to -\infty$ $\quad f(x) \to -\infty$ $\quad$ left end

#13) $f(x) = 5x^3 - 17x^2 + 4x + 14$

(a) $\frac{p}{q} = \frac{\pm 1, \pm 2, \pm 7, \pm 14}{\pm 1, \pm 5} \Longrightarrow$

$\frac{p}{q} = \pm 1, \pm 2, \pm 7, \pm 14, \pm \frac{1}{5}, \pm \frac{2}{5}, \pm \frac{7}{5}, \pm \frac{14}{5}$

then rational $= \frac{7}{5}$ By use of Calculator

$$\begin{array}{r|l} & 5x^2 - 10x - 10 \\ \hline (x - \frac{7}{5}) & 5x^3 - 17x^2 + 4x + 14 \\ & \ominus 5x^3 \mp 7x^2 \\ \hline & -10x^2 + 4x + 14 \\ & \oplus -10x^2 \ominus + 14x \\ \hline & -10x + 14 \\ & -10x \mp 14 \\ \hline & 0 \end{array}$$

$(x - \frac{7}{5})(5x^2 - 10x - 10) = (x - \frac{7}{5})(5)(x^2 - 2x - 2)$

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

$= \frac{2 \pm \sqrt{4 + 8}}{2}$

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

Irrational

$= 1 \pm \sqrt{3}$

$f(x) = 5(x - \frac{7}{5})(x - (1 + \sqrt{3}))(x - (1 - \sqrt{3}))$

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#13 b) $g(x) = 3x^4 - 20x^3 + 51x^2 - 86x + 40$

$p = \pm 1, \pm 2, \pm 4, \pm 5, \pm 8, \pm 20, \pm 10, \pm 40$

$q = \pm 1, \pm 3$

$\frac{p}{q} = \pm 1, \pm 2, \pm 4, \pm \quad , \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{4}{3}, \ldots$

$\boxed{x = \frac{2}{3}, \text{ and } x = 4}$ Rational Zeros

$(x - \frac{2}{3})(x - 4) = x^2 - 4x - \frac{2}{3}x + \frac{8}{3}$

$= x^2 - \frac{14}{3}x + \frac{8}{3}$

$$\begin{array}{r|l} & 3x^2 - 6x + 15 \\ \hline x^2 - \frac{14}{3}x + \frac{8}{3} & 3x^4 - 20x^3 + 51x^2 - 86x + 40 \\ & \ominus 3x^4 \oplus 14x^3 \ominus 8x^2 \\ \hline & -6x^3 + 43x^2 - 86x \\ & \oplus 6x^3 \ominus 28x^2 \oplus 16x \\ \hline & 15x^2 - 70x + 40 \\ & 15x^2 - 70x + 40 \\ \hline & 0 \end{array}$$

$(x - \frac{2}{3})(x - 4)(3x^2 - 6x + 15)$

$x = \frac{+6 \pm \sqrt{36 - 4(3)(15)}}{2(3)} = \frac{6 \pm \sqrt{-144}}{6} = \frac{6 \pm 12i}{6} = 1 \pm 2i$ Non Real Complex

$f(x) = 3(x - \frac{2}{3})(x - 4)(x - 1 - 2i)(x - 1 + 2i)$

#14 (a) The data appears to fit a cubic or a sinusoidal model

(b) $f(x) = ax^3 + bx^2 + cx + d$

$a = 0.307723$

$b = -9.79023$

$c = 71.19886595$

$d = 1277.18$

c) 2nd trace value $x = 25 \Rightarrow y = 1746$ thousand students

$= 1746000$ students

d) 2.5 million $= 2.5 \times 1000000 =$

$2500{,}000$

let $Y_2 = 2500$

2nd trace intersect

$X = 28.6 \approx 29$

$1975 + 29 =$ Year 2004

e) Because the end behavior is as $x \to \infty$ $f(x) \to \infty$

Realistically this is unlikely to happen