Show all work that supports your answers. If one problem is taking you too long move on and come back to it later. No one ever said you had to do the problems in the order they are presented.

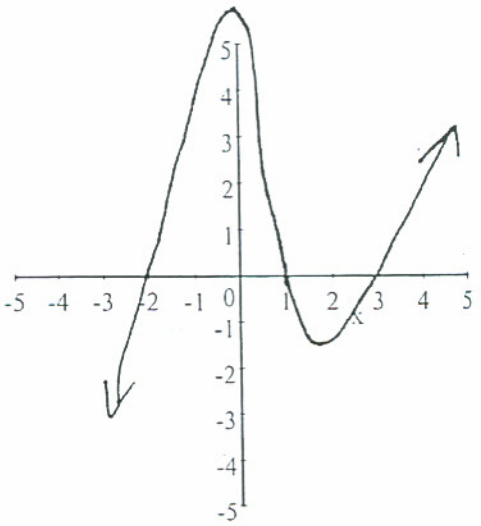
1) (12 pts) $f(x) = x(x-3)(x+2)^2(x-1)^3$

a) What is the degree of $f(x)$? 3

b) What are the roots of $f(x)$? $3, -2, 1$

c) What is the "y" intercept of $f(x)$? 6

d) Draw a reasonable graph of $f(x)$?



2) (12 pts) $f(x) = 12x - 4$ and $g(x) = \frac{1}{12}x + 4$

a) Find $(f \circ g)(x)$

b) Find $(g \circ f)(x)$

c) Are $f(x)$ and $g(x)$ inverses of each other?

a) $(f \circ g)(x) = 12\left(\frac{1}{12}x + 4\right) - 4$

$= x + 4 - 4$

$= x$

b) $(g \circ f)(x) = \frac{1}{12}(12x - 4) + 4$

$= x - 4 + 4$

$= x$

c) YES, THEY ARE INVERSES

3) (10 pts) $f(x) = 3x^3 + 9$ find $f^{-1}(x)$

$$y = 3x^3 + 9$$

$$x = 3y^3 + 9$$

$$\frac{x-9}{3} = \frac{3y^3}{3}$$

$$\frac{x-9}{3} = y^3$$

$$\sqrt[3]{\frac{x-9}{3}} = y$$

4) (9pts) $f(x)$ is a one to one function where: $f(1) = 0$, $f(2) = 1$, $f(10) = 8$, $f(6) = 4$, $f(8) = 6$

Find a) $f^{-1}(6) = 4$

b) $f(f(2)) = 0$

c) $f(f^{-1}(5)) = 5$

5) (3 pts) If $f(x)$ is a one to one function with a domain of $[8,12]$ and a range of $[-4,0)$. What is the range of $f^{-1}(x)$?

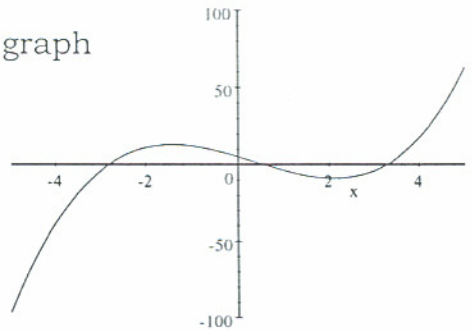
$[8,12]$

6) (3 pts) Which of the following is true about the graph

a) It is not a function

b) It is a function, but it is not 1 to 1

c) It is a 1 to 1 function



7) (10 pts) Rewrite each expression in exponential or logarithmic form

Log form	Exponential form
$\log_3 x = 7$	$3^7 = x$
$\ln 4 = y$	$e^y = 4$
$\log_x 11 = 2$	$2^x = 11$
$\ln e = 2x$	$e = x^2$
$2\log 4 = z$ $\log 16 = z$	$10^z = 16$

8) (3 pts) Rewrite $2\log x - \log z + \frac{1}{2}\log 3y$ as one logarithm

$= \log x^2 - \log z + \log 3y^{\frac{1}{2}}$

$= \log\left(\frac{x^2}{z}\right) + \log 3\sqrt{y}$

$= \log\left(\frac{x^2 3\sqrt{y}}{z}\right)$

9) (8 pts) Recall that the equation for compound interest is: $A = P\left(1 + \frac{r}{m}\right)^{mt}$

Suppose \$5,000 is invested at an interest rate of 7% annually in an account where interest is compounded monthly.

a) How much will the account be worth in 10 years?
b) How many years will it take for your investment to be worth \$30,000

a) $A = 5000\left(1 + \frac{.07}{12}\right)^{12(10)}$

$= 5000(1.006)^{120}$

$= \$10,250.09$

b) $\frac{30000}{5000} = \frac{5,000}{5000}(1.006)^{12t}$

$6 = (1.006)^{12t}$

$\frac{\ln 6}{12} = \frac{12t \ln(1.006)}{12}$

$\frac{\frac{\ln 6}{12}}{1.006} = \frac{t \ln 1.006}{\ln 1.006}$

$\frac{\frac{\ln 6}{12}}{1.006} = t$

Solve the following equations for x leave answers in exact form

10) (6 pts) $2^{x^2} = 8^{x+\frac{4}{3}}$

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

$2^{x^2} = 2^{3x+4}$

$x^2 = 3x+4$

$x^2 - 3x - 4 = 0$

$(x-4)(x-1) = 0$

$x = 4$ or $x = 1$

11) (6 pts) $7^{2x+1} = 9$

$2x+1 = \log_7 9$

$-1 \quad -1$

$\frac{2x}{2} = \frac{\log_7 8}{2}$

$x = \frac{\log_7 8}{2}$

12) (6 pts) $\ln(2x)^2 = 30$

$\frac{2\ln(2x)}{2} = \frac{30}{2}$

$\ln x = 15$

$x = e^{15}$

13) (6 pts) $\log_3(x+1) = \log_3(4x-6) - \log_3(2)$

$\log_3(x+1) = \log_3\left(\frac{4x-6}{2}\right)$

$x+1 = \frac{4x-6}{2}$

$x+1 = 2x-3$

$-x \quad -x$

$1 = x-3$

$+3 \quad +3$

$4 = x$

14) (6 pts) How long will it take any quantity of Iodine 131 to decay to 25% of its initial amount, knowing that it decays according to the function below, where t is time in days.

$P = p_0 e^{-.084t}$

$\frac{25P_0}{P_0} = \frac{P_0 e^{-.084t}}{P_0}$

$25 = e^{-.084t}$

$\ln 25 = -.084t$

$\frac{\ln 25}{-.084} = \frac{-.084t}{-.084}$

$\frac{\ln 25}{-.084} = t \Rightarrow t \approx -38.3$