Math 180 – Review Chapter 3 Name______________________________

Re – do all handouts and do the review from the book. Remember to SHOW ALL STEPS. You must be able to solve analytically and then verify with a graph.

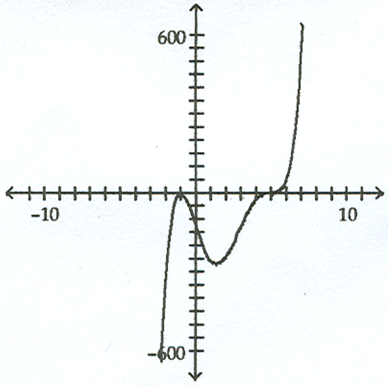
Find the rational zeros of the polynomial. List any irrational zeros correct to two decimal places.

1) $f(x) = x^3 + 3x^2 - 4x - 12$ $x^2(x+3) - 4(x+3) = 0$ $(x+3)(x^2-4) = 0$

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

Match the polynomial function graph to the appropriate zeros and multiplicities.

2) Do not use the calculator. Explain your reasoning.



r even multiplicity Graph touches at $x = r$
r odd " Graph crosses at $x = r$

A) –1 (multiplicity 3), 5 (multiplicity 3)
B) –1 (multiplicity 3), 5 (multiplicity 2)
[✓ C)] –1 (multiplicity 2), 5 (multiplicity 3)
D) –1 (multiplicity 2), 5 (multiplicity 2)

Use regression to solve the problem. Round numbers to the nearest hundredth.

3) The first column shows the independent variable (x). The second column shows the dependent variable (y).

x	y
10	35
12	40
15	49
17	58
20	63
22	70
25	76
28	88
30	91

$\boxed{\text{Stat}}$ $\boxed{\text{Edit}}$ and plug in the x, y values

$\boxed{\text{Stat}}$ $\boxed{\text{CALC}}$ $\boxed{5}$ $\boxed{\text{2nd}}$ $\boxed{1}$ $\boxed{,}$ $\boxed{\text{2nd}}$ $\boxed{2}$ $\boxed{,}$

$\boxed{\text{VARS}}$ $\boxed{\text{Y-VARS}}$ $\boxed{\text{FUNCTION}}$

$\boxed{Y_1}$ $\boxed{\text{Enter}}$

$\boxed{y_1 = -0.00905x^2 + 3.198x + 3.7}$

Find the quadratic regression equation. (Use your calculator: STAT, CALC, choose the quadratic model) (This is similar to the linear regression done in section 2.2)

Solve the problem.

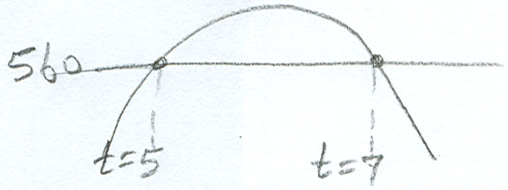
4) A flare fired from the bottom of a gorge is visible only when the flare is above the rim. If it is fired with an initial velocity of 192 ft/sec, and the gorge is 560 ft deep, during what interval can the flare be seen?
($h = -16t^2 + v_ot + h_o$.)

$V_o = 192$ ft/sec

$h_o = 0$

$h(t) = -16t^2 + 192t$

We want $-16t^2 + 192t > 560$



let $Y_1 = -16X^2 + 192X$

$Y_2 = 560$

$\boxed{5 < x < 7 \text{ seconds}}$

$+15P = 450 - X \Rightarrow \underset{\text{price}}{P} = \frac{450 - X}{15}$

5) The price p dollars and the quantity x sold of a certain product obey the demand equation
$x = -15p + 450, 0 \le p \le 30.$

(a) Express the revenue R as a function of x. $R(X) = X\left(\frac{450 - X}{15}\right) = 30X - \frac{1}{15}X^2$

(b) What quantity x maximizes the revenue? $X = -\frac{b}{2a} = \frac{-30}{2(-1/15)} = 225$ units

(c) What price should the company charge to maximize revenue?

$P = \frac{450 - 225}{15} = \$15$ per unit

6) The number of mosquitoes M(x), in millions, in a certain area depends on the June rainfall x, in inches: $M(x) = 17x - x^2$. What rainfall produces the maximum number of mosquitoes? Solve algebraically. Then check the work with the calculator. Show your graph.

$X = \frac{-b}{2a} = \frac{-17}{2(-1)} = \frac{17}{2} = 8.5$ inches

7) The concentration C of a certain drug in a patient's bloodstream is given by
$\frac{30t}{t^2 + 49}$.

(a) Find the horizontal asymptote of $C(t)$. $y = 0$

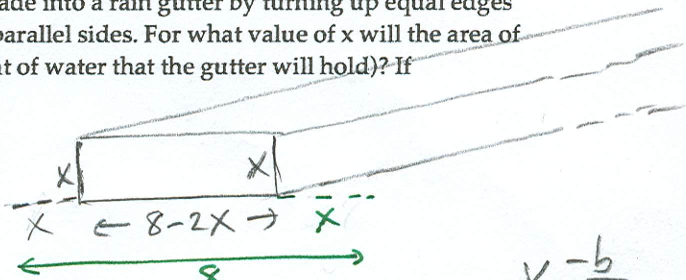
(b) Using a graphing utility, determine the time at which the concentration is highest.

$\boxed{\text{2nd}}\ \boxed{\text{trace}}\ \boxed{\text{max}}\ \boxed{\text{Enter}}\ \boxed{\text{Enter}}\ \boxed{\text{Enter}}$ $t = 7$

8) A piece of rectangular sheet metal is 8 inches wide. It is to be made into a rain gutter by turning up equal edges to form parallel sides. Let x represent the length of each of the parallel sides. For what value of x will the area of the cross section be a maximum (and thus maximize the amount of water that the gutter will hold)? If necessary, round to 2 decimal places.

$\text{Area} = X(8 - 2X) = 8X - 2X^2$

$X_{\text{vertex}} = \frac{-b}{2a} = \frac{-8}{2(-2)} = 2$ inches



9) A developer wants to enclose a rectangular grassy lot that borders a city street for parking. If the developer has 320 feet of fencing and does not fence the side along the street, what is the largest area that can be enclosed?

$2X + y = 320 \Rightarrow y = 320 - 2X \Rightarrow A = Xy = X(320 - 2X) = 320X - 2X^2$

$X = \frac{-b}{2a}$

$X = \frac{-320}{2(-2)}$

$X = 80\text{ft}$

$\boxed{A = 12800\ \text{ft}^2}$

10) A ball is thrown vertically upward with an initial velocity of 192 feet per second. The distance in feet of the ball from the ground after t seconds is $s = 192t - 16t^2$. For what interval of time is the ball more than 432 above the ground?

$192t - 16t^2 > 432$ Solve By Graphing

$3 < X < 9$ seconds

Write the product in standard form.

11) $(2 + 6i)(3 + 3i)$

$= 6 + 6i + 18i + 18i^2 = 6 + 24i - 18 = \boxed{-12 + 24i}$

12) $(8 + 9i)(8 - 9i)$

$= 64 - \cancel{72i} + \cancel{72i} - 81i^2$ But $i^2 = -1$

$= 64 - 81(-1)$

$\boxed{= 145}$

Graph the function without the calculator.
What is the degree?
What is the end behavior?
What are the zeros?
Specify the multiplicity of each zero and indicate whether the graph crosses, bounces or sits and crosses the x–axis.

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

Degree = 3 ↑
End Behavior ↘

Zeros	$x=0$	$x=1$	$x=2$
Multiplicity	1	1	1
Graph	Crosses x axis	Crosses x axis	Crosses x axis

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

Degree = 5 ↑
End Behavior ↓

Zeros	$x=-1$	$x=-3$	$x=1$
Mult.	3	1	1
Graph	Cross x axis	Cross x axis	Cross x axis

List the x– and y–intercepts.

15) $f(x) = \frac{-3}{x-6}$

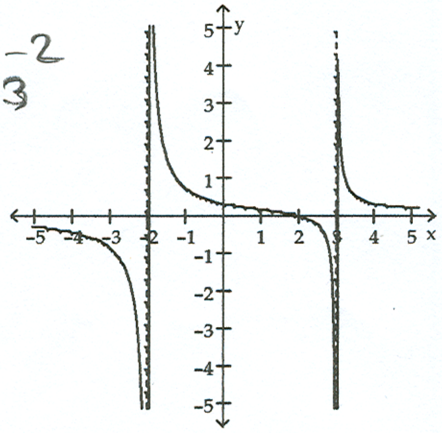
Xint = None; yint = $(0, \frac{1}{2})$

Make up a rational function that has the given graph.

16)

V.A $x = -2$
$x = 3$

H.A $y = 0$



$R(x) = \frac{x-2}{(x+2)(x-3)}$

Give the equation of the specified asymptote(s).

17) Horizontal asymptote: $h(x) = \frac{8x^2 - 9x - 7}{5x^2 - 8x + 9}$ ⟹ Degree m = n take Ratio; $y = \frac{8}{5}$ is the H.A

18) Horizontal asymptote: $g(x) = \frac{x^2 + 5x - 3}{x - 3}$ None; H.A Degree m > n

19) Oblique asymptote: $f(x) = \frac{x^2 + 2x - 2}{x - 8}$ O.A $y = x + 10$

See Long Division Below

20) Vertical asymptote(s): $f(x) = \frac{x - 1}{x^2 + 8}$ No V.A

$$\begin{array}{r} \boxed{x+10} \\ x-8\,\overline{)\,x^2+2x-2} \\ \ominus x^2 \overset{\oplus}{-} 8x \\ \hline 10x-2 \\ \ominus 10x \overset{\oplus}{-} 80 \\ \hline 78 \end{array}$$

Use the Factor Theorem to determine whether x – c is a factor of f. $\boxed{\text{Yes}}$

21) $f(x) = 5x^2 - 22x + 21; c = 3$ $f(3) = 0$ then $X-3$ is a factor of $f(x)$

Find the zeros of the function.

22) $f(x) = 3x^3 + 7x^2 - 20x$ (do this algebraically, by factoring!!!) let $f(x) = 0$

$X(3X^2 + 7X - 20) = 0$

$X(3X-5)(X+4) = 0 \Rightarrow \boxed{X=0}\ \boxed{X=\frac{5}{3}}\ \boxed{X=-4}$

For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses, bounces or sits and crosses the x-axis at each x -intercept.

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

$-\frac{1}{2}$ multiplicity 4 touches X-axis

6 multiplicity 3 Crosses X-axis

Write two cubic functions with the given zeros.

24) –5, 2, –6

$f(x) = (X+5)(X-2)(X+6) = (X+5)(X^2+4X-12) = X^3+4X^2-12X+5X^2+20X-60$

$= X^3+9X^2+8X-60$

Find the x- and y-intercepts of the graph.

25) $y = -2(x + 3)^2 + 8$

Yintercept $(0, -10)$; Xintercept $0 = -2(X+3)^2+8 \Rightarrow 2(X+3)^2 = 8$

$(X+3)^2 = 4$

$X+3 = \pm 2$

$X = \pm 2 - 3$

$X = -1$

$X = -5$

$\boxed{(-5, 0)(-1, 0)}$

Using the Remainder Theorem, find the remainder when f(x) is divided by g(x).

26) $f(x) = 5x^6 - 3x^3 + 8; g(x) = x + 1$ $f(-1) = 16$

State the domain of the rational function.

27) $f(x) = \dfrac{x - 1}{x^2 + 5}$

Domain is all Reals

For the given function, find all asymptotes of the type indicated (if there are any)

28) $f(x) = \dfrac{9x^2 + 6}{9x^2 - 6}$, horizontal

$y = \frac{9}{9} = 1$ is the H.A

29) $f(x) = \dfrac{x^2 + 2x + 4}{x + 9}$, slant

$$\begin{array}{r} X - 7 \\ X+9\ \overline{)\ X^2 + 2X + 4} \\ \ominus X^2 \ominus 9X \\ \hline -7X + 4 \\ \oplus 7X \oplus 63 \\ \hline 67 \end{array}$$

slant or Oblique Asymptote

$\boxed{y = X - 7}$

30) $f(x) = \dfrac{x - 6}{x^2 - 4}$, vertical

$x^2 - 4 = 0$

$(x+2)(x-2) = 0$

$\boxed{X = 2 \text{ and } X = 2}$

Give the domain of the function.

31) Find the domain of $R(x) = \frac{x^2 + x - 20}{x^2 - 14x + 48}$. $= \frac{(x+5)(x-4)}{(x-6)(x-8)}$ Domain is all Reals except $x = +6$ and $x = 8$

Solve the inequality, then graph its solution. Use interval notation.

32) $\frac{(x - 1)(3 - x)}{(x - 2)^2} \le 0$

$x \le 1 \cup x \ge 3$

$\boxed{(-\infty, 1] \cup [3, \infty)}$

− − − ● + + + $x - 1$ (1)

+ + + + + + ● − $3 - x$ (3)

− − − − o + + $x - 2$

− − − − o + + (2)

− − − ● + o + ● − (1, 2, 3)

33) $x^2 + 5x \ge -4$ Do analytically, then verify with a graph.

$x^2 + 5x + 4 \ge 0$

$(x+4)(x+1) \ge 0$

− − − ● + + + + +

− − ● + + + + + + + +

+ −4 − ● + + +

$\boxed{(-\infty, -4] \cup [-1, \infty)}$

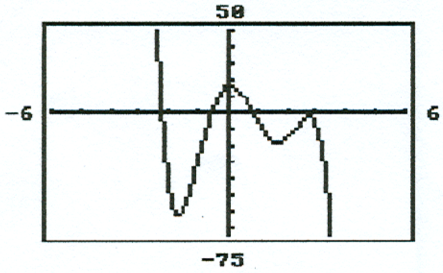
Find the vertex and axis of symmetry of the graph of the function.

34) $f(x) = 4x^2 + 24x - 1$ $x_{vertex} = \frac{-b}{2a} = \frac{-24}{2(4)} = -3 \Rightarrow (-3, -37)$ vertex

axis of sym $x = -3$

Match the given graph with its polynomial function.

35)



use window
Xmin = −6
Xmax = 6
Ymin = −75
Ymax = 50

Note: End Behavior is a Power function of odd Power and Negative Coefficient.

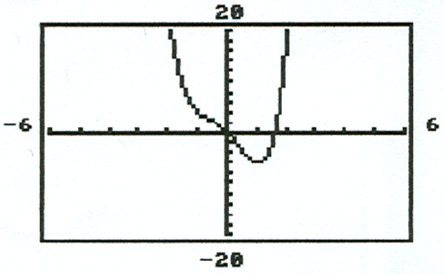
A) $f(x) = -x^6 + 7x^5 - x^2 - 2x + 16$

[✓ B)] $f(x) = -2x^5 + 7x^4 + 9x^3 - 40x^2 + 4x + 16$

C) $f(x) = 2x^6 + 9x^3 - 7x^2 + 4x - 16$

D) $f(x) = x^5 + 7x^4 - x^3 - 40x^2 + 2x + 16$

36) Explain how you decide. Do not graph the given functions given as answers with your calculator.



Note: End Behavior
a Power function of even Power and Positive leading Coefficient.

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

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

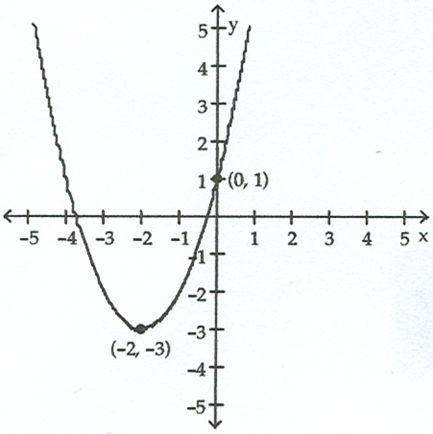
C) $f(x) = 2x^5 + x^3 + 8x^2 - 4x + 3$

[✓ D)] $f(x) = 2x^4 + x^3 - 3x^2 - 6x$

$y = a(x-h)^2 + K \quad (h, K) = (-2, -3)$

Determine the quadratic function whose graph is given.

42)



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

and when $x = 0$ $y = 1$

$1 = a(0+2)^2 - 3$

$1 = 4a - 3 \Rightarrow \boxed{a = 1}$

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

For the polynomial, one zero is given. Find all others. $(x+2i)(x-2i) = x^2 - \cancel{2i}x + \cancel{2i}x - 4i^2 = x^2 + 4$

43) $P(x) = x^4 - 5x^2 - 36$; $-2i$ $\Longrightarrow$ $x^4 - 5x^2 - 36 = (x^2-9)(x^2+4) = 0$

$x^2 = 9 \Rightarrow \boxed{x = \pm 3; -2i; 2i}$

44) $P(x) = x^4 - 45x^2 - 196$; $-2i$ $x^4 - 45x^2 - 196 = (x^2-49)(x^2+4) = 0 \Rightarrow \boxed{x = \pm 7; -2i; 2i}$

45) $P(x) = x^3 + 3x^2 - 8x + 10$; $1 + i$ $(x-(1+i))(x-(1-i))$

$\boxed{x = 1 - i \text{ and } -5}$

$= (x-1-i)(x-1+i) = x^2 - x + \cancel{ix} - \cancel{x} + 1 - \cancel{i} - \cancel{ix} + \cancel{i} - i^2 = x^2 - x + 1$

By long Division the other factor is $x + 5$

Answer the question.

46) For the polynomial $f(x) = (x-2)^3(x-3)^2(x-4)$

(a) Find the x– and y–intercepts of the graph of f.

(b) Determine whether the graph crosses or touches the x–axis at each x–intercept.

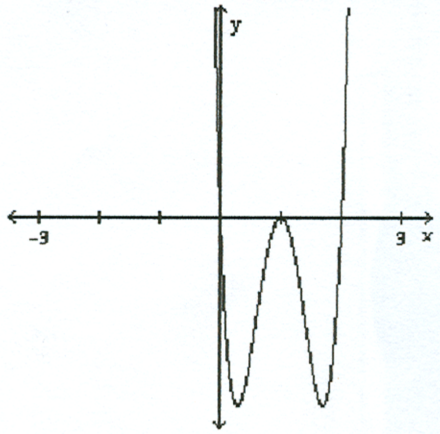
(c) End behavior: find the power function that the graph of f resembles for large values of $|x|$.

(d) Use a graphing utility to graph the function. Determine the number of turning points on the graph.

(e) Approximate the local minima rounded to two decimal places.

(f) Put all the information together, and connect the points with a smooth, continuous curve to obtain the graph of f. (Please See Page 12 of the Packet)

47) Which of the following polynomial functions might have the graph shown in the illustration below?



Graph touches at $x = 1$; then even Mult.

Graph Crosses at $x = 0$ and $x = 2$ then odd Multiplicity

End Behavior ax^n, and $a > 0$ n is even

A) $f(x) = x^2(x-2)^2(x-1)^2$

B) ~~$f(x) = x(x-2)^2(x-1)$~~

C) $f(x) = x^2(x-2)(x-1)$

D) $\boxed{f(x) = x(x-2)(x-1)^2}$

Find the real solutions of the equation.

48) $2x^3 - x^2 - 20x + 10 = 0$

$\rightarrow x^2(2x-1) - 10(2x-1) = 0$

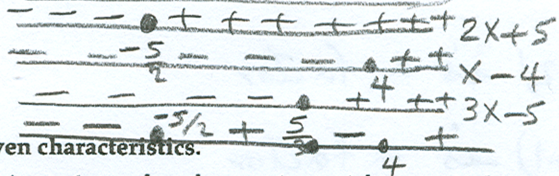
$(2x-1)(x^2-10) = 0$

$2x-1=0 \qquad x^2-10=0$

$\boxed{x = \frac{1}{2}} \qquad \boxed{x = \pm\sqrt{10}}$

49) Solve the inequality
$(2x + 5)(x - 4)(3x - 5) \le 0$

$\boxed{(-\infty, -\frac{5}{2}] \cup [\frac{5}{3}, 4]}$



Construct a rational expression with the given characteristics.

50) The graph of R(x) crosses the x-axis at −1, touches the x-axis at −4, has vertical asymptotes at x = −2 and x = 3, and has one horizontal asymptote at y = −2.

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

Write the sum or difference in the standard form a + bi.

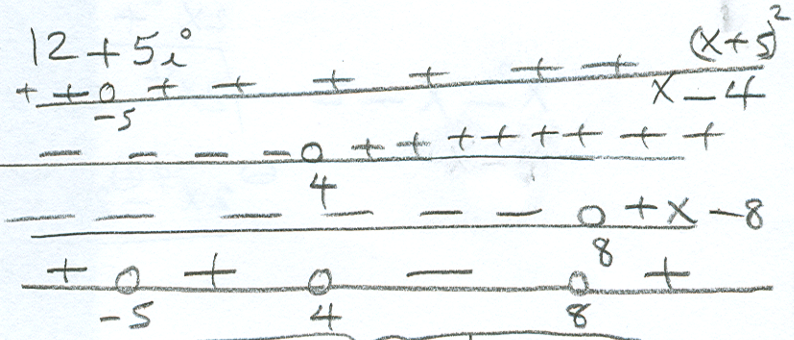
51) $(2 - 4i) + (4 + 2i)$ $= 6 - 2i$

52) $(5 + 6i) - (-7 + i)$ $= 5 + 6i + 7 - i = 12 + 5i$

Determine the intervals where the function is positive.

53) $f(x) = (x+5)^2 \ (x - 4)\ (x - 8)$

$(-\infty, -5) \cup (-5, 4) \cup (8, \infty)$



Form a polynomial whose zeros and degrees are given.

54) Zeros: −3, multiplicity 2; 1, multiplicity 1; 5, multiplicity 3; degree = 6 $\boxed{(x+3)^2(x-1)^1(x-5)^3}$

Graph the quadratic function by determining whether the graph opens up or down and by finding its vertex, axis of symmetry, *y*-intercept, and *x*-intercepts, if any.

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

$\boxed{x_{\text{vertex}} = \frac{-3}{2(2)} = \frac{-3}{4} ; \ y_{\text{vertex}} = -2.125}$

$\boxed{\text{axis of symmetry } x = \frac{-3}{4}}$; $\boxed{\text{y intercept } (0, -1)}$ $\boxed{\text{x intercepts } (-1.78, 0) \text{ and } (0.28, 0)}$

56) Find the maximum or minimum value of the function. Specify whether it's a maximum or a minimum.

$f(x) = -x^2 + 8x + 2$ $\quad x_{\text{Vertex}} = \frac{-b}{2a} = \frac{-8}{2(-1)} = 4 ; \ \boxed{y_{max} = 18}$

Find the complex zeros of the polynomial P.

57) $P(x) = 2x^4 - 2x^3 + x^2 - 5x - 10$ Please See Next Page

Use transformations of the graph of $y = x^4$ to sketch the graph of the function.

58) $g(x) = -(x + 2)^4 - 3$

Shift graph of $y = x^4$ left 2 units, and down 3 ; also Reflect the result with respect to x axis

See page 8 for Graph

#57) $P(x) = 2x^4 - 2x^3 + x^2 - 5x - 10$

Possible Zeros are $\pm\frac{10}{2}, \pm\frac{5}{2}, \pm\frac{2}{2}, \pm\frac{10}{1}, \pm\frac{5}{1}, \pm\frac{2}{1}$

Note:

$P(2) = 0 \Rightarrow (x-2)$ is a factor

$P(-1) = 0 \rightarrow (x+1)$ is a factor

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

Now use long Division to find the other factors:

$$
\begin{array}{r|l}
 & 2x^2 + 5 \\
x^2 - x - 2 & 2x^4 - 2x^3 + x^2 - 5x - 10 \\
 & \ominus 2x^4 \overset{\oplus}{-} 2x^3 \overset{\oplus}{-} 4x^2 \\
\hline
 & \qquad 5x^2 - 5x - 10 \\
 & \qquad \ominus 5x^2 \overset{\oplus}{-} 5x \overset{\oplus}{-} 10 \\
\hline
 & \qquad\qquad 0
\end{array}
$$

Hence; $2x^4 - 2x^3 + x^2 - 5x - 10 = (x^2 - x - 2)(2x^2 + 5) = 0$

$\Rightarrow (x-2)(x+1)(2x^2+5) = 0$

$\boxed{x=2}$ $\boxed{x=-1}$ $2x^2 = -5$

$x^2 = -\frac{5}{2}$

$\boxed{x = \pm\sqrt{\frac{5}{2}}\, i}$

Zeros are:

$-1, 2, \frac{\sqrt{10}}{2}i, -\frac{\sqrt{10}}{2}i$

Rationalizing Denominator $= \pm\frac{\sqrt{5}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} i$ OR

we get $\rightarrow$ $\boxed{= \pm\frac{\sqrt{10}}{2} i}$

$p = \pm 1, \pm 3$ $q = \pm 1, \pm 5$

List the potential rational zeros of the polynomial function. Do not find the zeros.

59) $f(x) = 5x^3 - x^2 + 3$ $\frac{p}{q} = \pm\frac{3}{5}, \pm\frac{3}{1}, \pm\frac{1}{5}, \pm 1$

Find all real zeros of the given polynomial function P, and use the real zeros to factor P.

60) $P(x) = 2x^3 + 3x^2 - 9x - 10$ Real Zeros $x = -1, -\frac{5}{2}, 2 \Rightarrow P(x) = (x+1)(2x+5)(x-2)$

Write the expression in the form bi, where b is a real number.

61) $\sqrt{-16} = 4i$

Form a polynomial f(x) with real coefficients having the given degree and zeros. $(x-1)(x-(3+i))(x-(3-i))$

62) Find a third-degree polynomial function with real coefficients and with zeros 1 and $3 + i$. $= (x-1)(x-3-i)(x-3+i)$

A) $f(x) = z^3 + 7z^2 + 16z + 10$

B) $f(x) = z^3 - 7z^2 + 4z - 10$ Multiply and get

C) $f(x) = z^3 - 5z^2 + 4z + 10$

[✓ D) $f(x) = z^3 - 7z^2 + 16z - 10$]

Find the requested function.

63) Find the cubic function with the given table of values. Zeros are $-7, -4$ and 4

x	-7	-4	2	4
f(x)	0	0	216	0

$\boxed{(x) = -2(x+7)(x+4)(x-4)}$

$f(x) = a(x+7)(x+4)(x-4)$

$f(2) = 216 \Rightarrow a(2+7)(2+4)(2-4) = 216$

$a(9)(6)(-2) = 216 \Rightarrow a = \frac{216}{-108} = -2$

Solve the equation.

64) $x^2 + x + 7 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{1 - 4(7)}}{2} = \frac{-1 \pm \sqrt{-27}}{2} = \boxed{\frac{-1 \pm 3\sqrt{3}i}{2}}$

Information is given about a complex polynomial f(x) whose coefficients are real numbers. Find the remaining zeros of f.

65) Degree 6; zeros: –2, 2 + i, –3 – i, 0 Remaining Zeros are $2 - i, -3 + i$

Construct a polynomial with the given properties.

66) The graph of the polynomial crosses the x–axis at –2 and 3, touches the x–axis at 5, crosses the y–axis at –5 and is below the x–axis between –2 and 3. $y = a(x+2)^1(x-3)^1(x-5)^2$

when $x = 0$
$y = -5$

$-5 = a(0+2)(0-3)(0-5)^2$

$-5 = a(-6)(25) \Rightarrow a = \frac{5}{6(25)} = \frac{1}{30}$

$\boxed{y = \frac{1}{30}(x+2)(x-3)(x-5)^2}$

Determine the x values that cause the function to be (a) zero, (b) undefined, (c) positive, and (d) negative.

67) $f(x) = \frac{(x-6)}{(2x+1)}$

a) when $x = 6$ $f(x)$ is zero

b) when $x = \frac{-1}{2}$ $f(x)$ is undefined

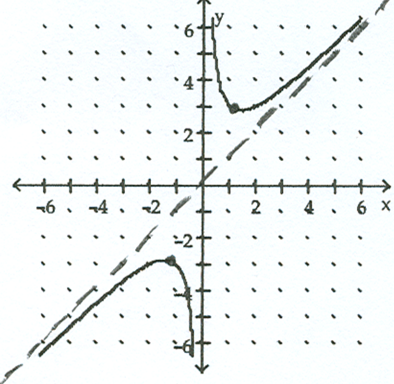
c) Positive $(-\infty, -\frac{1}{2}) \cup (6, \infty)$

d) Negative $(\frac{-1}{2}, 6)$

$y = x$

Match the correct function to a given graph.

37) Select the function given that matches the graph. You should be able to do this without the calculator!!!!! Show how you make the selection.



Note: the slant Asymptote is

$y = x$

x	y
1	3
-1	-3

A) $f(x) = x + \frac{1}{x}$ ~~B) $f(x) = 2x + \frac{1}{x}$~~ ~~C) $f(x) = x + 2$~~ $\boxed{\text{D) } f(x) = x + \frac{2}{x}}$

Use the intermediate value theorem to show that the polynomial has a real zero in the interval [a, b].

38) $a = -1$ and $b = 0$

$f(x) = 7x^3 + 5x^2 + 10x + 9$

$f(0) = 9$ and $f(-1) = -3$

Since $f(x)$ is a polynomial and continuous over $\mathbb{R}$ and $-3 < 0 < 9$ then by IVT There exists a constant c in $(-1, 0)$ So that $\boxed{f(c) = 0}$

Analyze the graph of the rational function for the given step.

39) Find the vertical asymptote(s) and/or hole(s) for $R(x) = \frac{x^2 + x - 56}{x^2 - x - 42}$.

$R(x) = \frac{(x+8)\cancel{(x-7)}}{\cancel{(x-7)}(x+6)}$

Domain is all $\mathbb{R}$ except $x = 7$ and $x = -6$

But Vertical Asymptote is $\boxed{x = -6}$; Graph has a hole at $(7, \frac{15}{13})$

Solve the inequality.

40) $\frac{x - 2}{(x + 9)^2} < 0$

$- \; - \; \underset{2}{|} \; + \; + \; +$

$\underset{-9}{+ \; 0 \; +} \; + \; + \; + \; + \quad (x+9)^2$

$- \; \underset{-9}{0} \; - \; \underset{2}{0} \; + \; + \; +$

$\boxed{(-\infty, -9) \cup (-9, -2)}$

41) $(b + 6)(b + 1)(b - 1) < 0$ Do analytically. Then verify with a graph.

$- \; - \; - \; \underset{-6}{0} \; + \; + \; + \; + \; + \; + \quad b+6$

$- \; - \; - \; - \; - \; \underset{-1}{0} \; + \; + \; + \quad b+1$

$- \; - \; - \; - \; - \; - \; - \; \underset{1}{0} \; + \quad b-1$

$- \; - \; \underset{-6}{0} \; + \; \underset{-1}{0} \; - \; \underset{1}{0} \; + \quad (b+6)(b+1)(b-1)$

$(-\infty, -6) \cup (-1, 1)$