Pre-Calculus Name________________________ ID: 1

Review Chapter 4

Date________________ Period____

Use long division to divide the polynomials:

1) $\dfrac{3x^4 - 2x^3 - 3x^2 + 5}{3x + 7}$

$\boxed{x^3 - 3x^2 + 6x - 14 + \dfrac{103}{3x+7}}$

$3x+7 \overline{)\, 3x^4 - 2x^3 - 3x^2 + 5}$

$3x^4 + 7x^3$

$-9x^3 - 3x^2$

$-9x^3 - 21x^2$

$18x^2 + 5$

$18x^2 + 42x$

$-42x + 5$

$-42x - 98$

2) $\dfrac{2x^3 - 7x^2 - 2}{x^2 + 3}$

$\boxed{2x - 7 + \dfrac{-6x+19}{x^2+3}}$

$x^2+3 \overline{)\, 2x^3 - 7x^2 - 2}$

$2x^3 + 6x$

$-7x^2 - 6x - 2$

$-7x^2 - 21$

$-6x + 19$

Use Synthetic division to divide the polynomials:

3) $\dfrac{x^4 + 7x^2 + 12}{x - 2}$

2 | 1 0 7 0 12

2 4 22 44

1 2 11 22 56

$\boxed{x^3 + 2x^2 + 11x + 22 + \dfrac{56}{x-2}}$

4) $\dfrac{x^3 + 3x^2 - x - 1}{x + 4}$

-4 | 1 3 -1 -1

-4 4 -12

1 -1 3 -13

$\boxed{x^2 - x + 3 + \dfrac{-13}{x+4}}$

Use the remainder theorem to find P(c) or Q(c):

$P(x) = 6x^5 + 4x^3 - 5x^2 + 10]$ $Q(x) = -4x^4 + 3x^3 + x + 3$

5) $Q(-2)$

$Q(-2) = -87$

6) $P(4)$

$P(4) = 6330$

7) $P(-5)$

$P(-5) = \boxed{-19365}$

8) $Q(3)$

$\boxed{Q(3) = -237}$

3 | -4 3 0 1 3

-12 -27 -81 -240

-4 -9 -27 -80 -237

Write a polynomial with the given zeros in factored form:

9) $x = -3, 2, 1 + 3i$

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

10) $x = 2, -2, -2i$

$(x-2)(x+2)(x+2i)(x-2i)$

11) Write the polynomial in #9 in expanded form:

$\boxed{P(x) = x^4 - x^3 + 2x^2 + 22x - 60}$

12) Write the polynomial in #10 in expanded form:

$\boxed{P(x) = x^4 - 16}$

Write a list of all the possible rational zeros:

13) $P(x) = 4x^3 + 7x - 9$

$\frac{1, 3, 9}{1, 2, 4}$

$\pm\left(1, 3, 9, \frac{1}{2}, \frac{3}{2}, \frac{9}{2}, \frac{1}{4}, \frac{3}{4}, \frac{9}{4}\right)$

14) $P(x) = -6x^5 + 4x^3 - 2x^2 + 12$

$\frac{1, 2, 3, 4, 6, 12}{1, 2, 3, 6}$

$\pm\left(1, 2, 3, 4, 6, 12, \frac{1}{2}, \frac{3}{2}, \frac{1}{3}, \frac{2}{3}, \frac{4}{3}, \frac{1}{6}\right)$

Use Decarte's Rule to determine the number of positive and negative real zeros possible:

15) $P(x) = -7x^3 + 4x^2 + 2x - 3$

$- + + -$

$\boxed{\text{2 or 0 pos zeros}}$

$+ + - -$

$\boxed{\text{1 neg zero}}$

16) $P(x) = x^5 + 4x^4 - x^3 - x^2 - 7x + 1$

$+ + - - - +$

$\boxed{\text{2 or 0 pos zeros}}$

$- + + - + +$

$\boxed{\text{3 or 1 neg zeros}}$

For each of the following, factor the polynomial to help you find all the zeros:

17) $P(x) = x^4 - x^2 - 12$

$(x^2-4)(x^2+3)$

$(x+2)(x-2)(x+i\sqrt{3})(x-i\sqrt{3})$

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

18) $P(x) = 4x^3 + 32x^2$

$4x^2(x+8)$

$\boxed{x = 0, \text{mult } 2, \; -8}$

19) $P(x) = x^3 + 2x^2 - 9x - 18$

$x^2(x+2) - 9(x+2)$

$(x+2)(x^2-9)$

$(x+3)(x-3)$

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

20) $P(x) = x^3 - 2x^2 - 11x + 12$

1	1	-2	-11	12
		1	-1	-12
	1	-1	-12	0

$x^2 - x - 12$

$(x-4)(x+3)$

$\boxed{x = 1, 4, -3}$

Factor P(x) into linear and irreducible quadratic factors using all real coefficients:

21) $P(x) = x^3 - x^2 + 7x - 7$

$x^2(x-1) + 7(x-1)$

$\boxed{P(x) = (x-1)(x^2+7)}$

22) $P(x) = x^3 + 3x^2 - x - 6$

-2	1	3	-1	-6
		-2	-2	6
	1	1	-3	0

$x^2 + x - 3$

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

Factor P(x) completely (linear factors only)

23) $P(x) = x^3 + 3x^2 - 4x - 12$

$x^2(x+3) - 4(x+3)$

$(x+3)(x^2-4)$

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

24) $P(x) = 3x^4 - 15x^2 - 108$

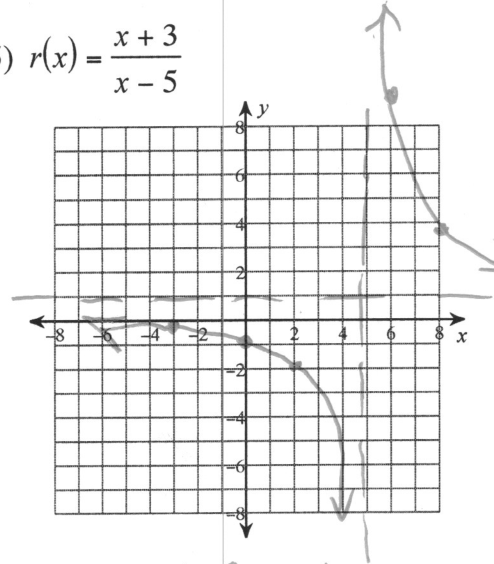
$3(x^4 - 5x - 36)$

$3(x^2-9)(x^2+4)$

$\boxed{P(x) = 3(x-3)(x+3)(x+2i)(x-2i)}$

For each of the following, find all the asymptotes and intercepts. Then graph

25) $r(x) = \dfrac{x + 3}{x - 5}$



2	$-5/3$
6	$9/1$
8	$11/3$

x-int: $(-3, 0)$

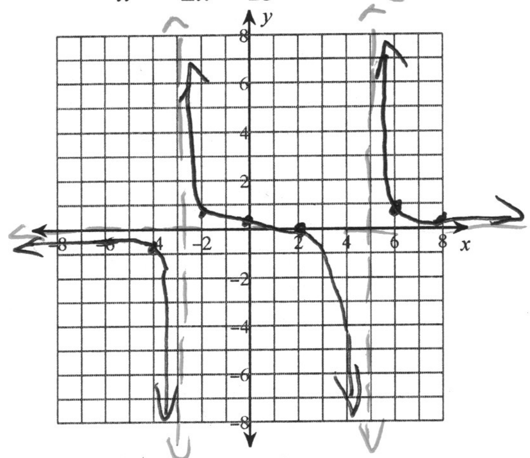
y-int: $(0, -3/5)$

V.A: $x = 5$

H.A: $y = 1$

26) $r(x) = \dfrac{x - 2}{x^2 - 2x - 15}$

$\dfrac{x-2}{(x-5)(x+3)}$



-2	$4/7$
4	$-2/7$
6	$4/9$
8	$2/11$
-4	$-2/3$
-6	$-8/33$

x-int: $(2, 0)$

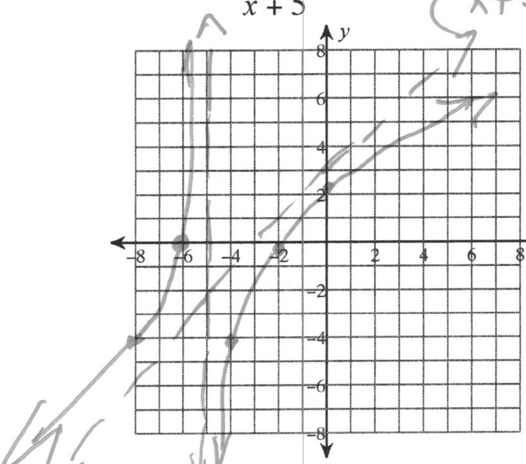
y-int $(0, 2/15)$

V.A: $x = 5, x = -3$

H.A: $y = 0$

27) $r(x) = \dfrac{x^2 + 8x + 12}{x + 5}$

$\dfrac{(x+2)(x+6)}{(x+5)}$



-4	$\dfrac{-2(2)}{1}$	-4
-8	$\dfrac{-6(-2)}{-3}$	-4

x-int: $(-2, 0)(-6, 0)$

y-int: $(0, 12/5)$

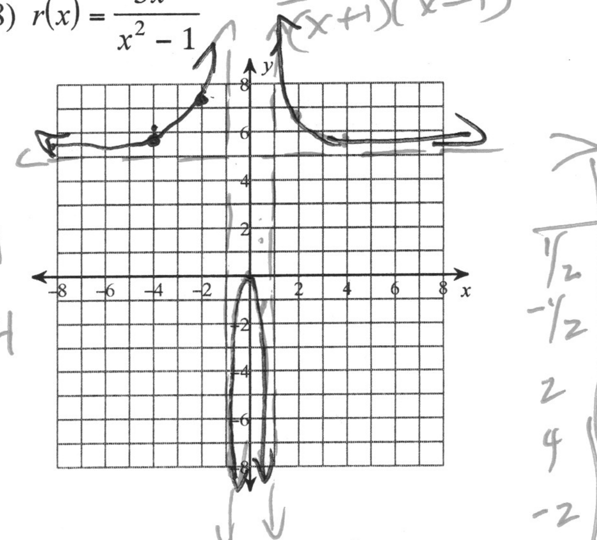
V.A. $x = -5$

H.A. none

SA. $y = x + 3$

28) $r(x) = \dfrac{5x^2}{x^2 - 1}$

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



$1/2$	$-5/3$
$-1/2$	$-5/3$
2	$20/3$
4	$16/3$
-2	$20/3$
-4	$16/3$

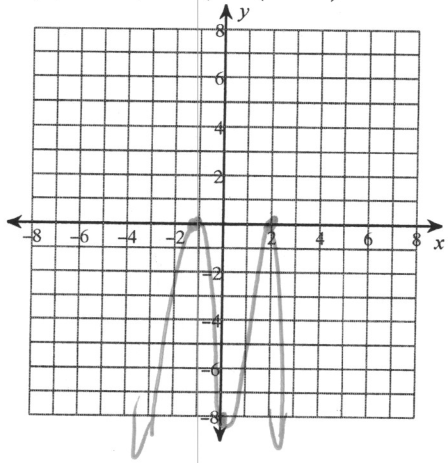
x-int: $(0, 0)$

y-int: $(0, 0)$

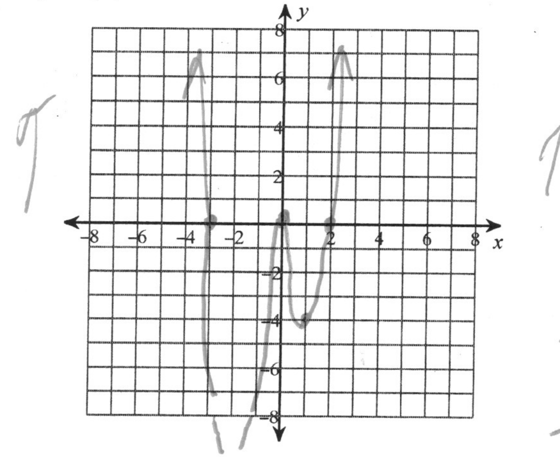
V.A: $x = 1, x = -1$

H.A. $y = 5$

33) $P(x) = -2(x-2)^2 \cdot (x+1)^2$



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

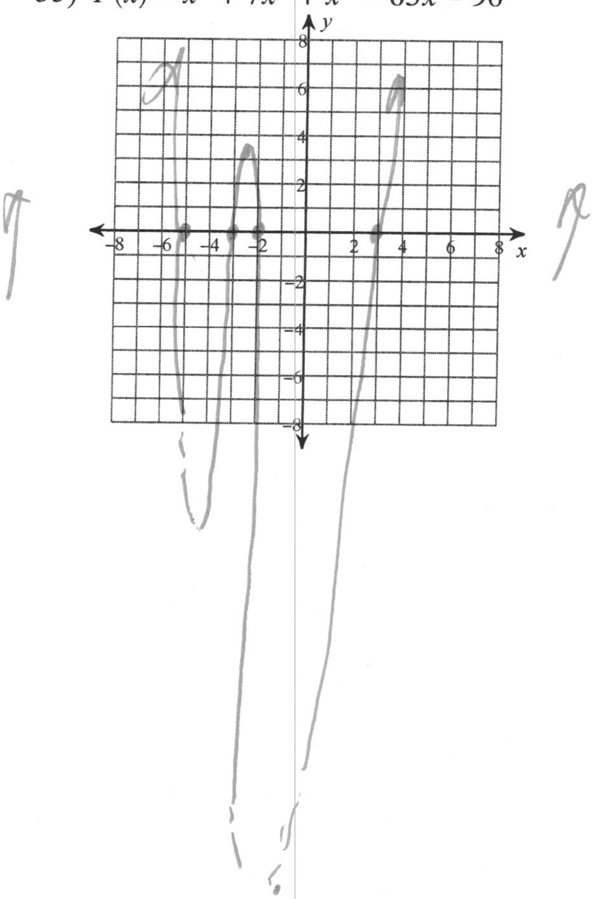


1	-4
-2	-16

$x^2(x^2+x-6)$

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

35) $P(x) = x^4 + 7x^3 + x^2 - 63x - 90$



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

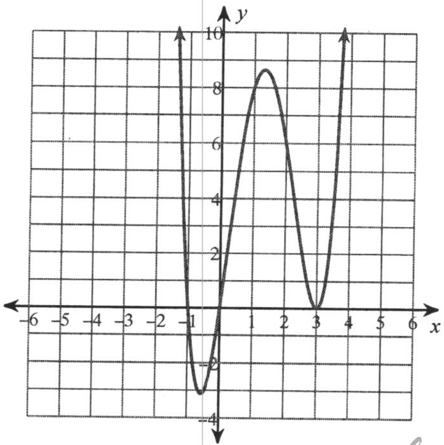
<u>Zeros</u>

$\pm 3, -2, -5$

-2.5	3.4
-4	-14

Find all the zeros of the polynomial function P(x) from the graph. Then write P(x) in expanded form.

29)

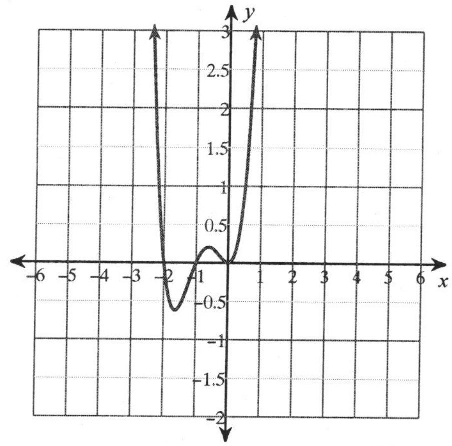


$(x+1)(x)(x-3)^2$

Zeros
$-1, 0, 3, 3$

$\boxed{f(x)=x^4-5x^3+3x^2+9x}$

30)



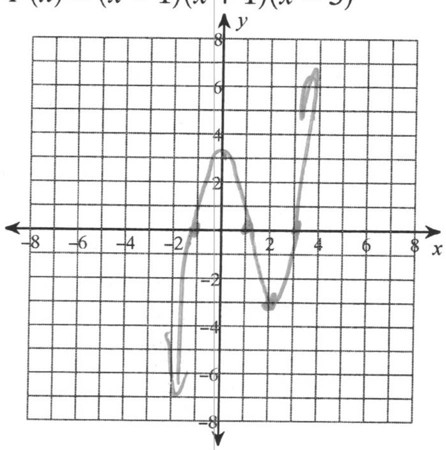
$(x+2)(x+1)x^2$

Zeros
$-2, -1, 0, 0$

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

Sketch the polynomial:

31) $P(x) = (x - 1)(x + 1)(x - 3)$



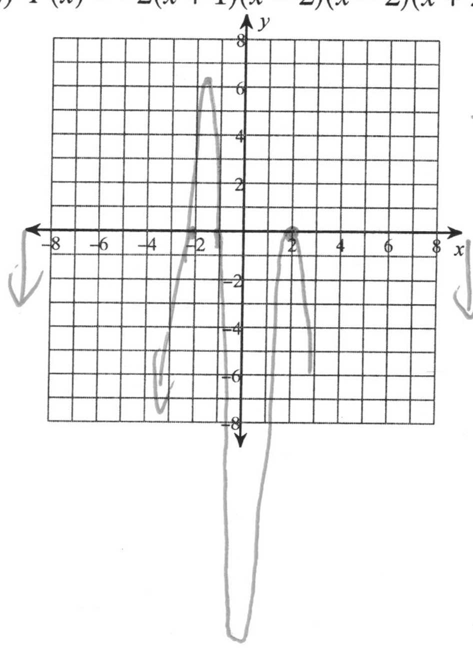
↓ ↑

$2 \mid -3$

Zeros
$1, -1, 3$

y-int
$(0, 3)$

32) $P(x) = -2(x + 1)(x - 2)(x - 2)(x + 2)$



Zeros
$-1, 2, -2$
↑ repeats

y-int
$(0, -16)$

$-1.5 \mid 6.125$