Name: hansen Date: _____ Period: _____

**Secondary Math III Honors**
**Module 3 Study Guide**
**Polynomials**

**Directions: Show all work.**

**Identify the following functions as linear, exponential, quadratic, cubic, or logarithmic.**

1. expon.

| x | y |
|---|---|
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |
| 3 | 8 |

2. cubic...

| x | y |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 8 |
| 3 | 27 |

3. Logarithmic (linear)

| x | y |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 4 | 2 |
| 8 | 3 |

4. Quadratic

| x | y |
|---|---|
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |
| 3 | 7 |

5. linear

| x | y |
|---|---|
| 0 | 1 |
| 1 | 2 |
| 2 | 3 |
| 3 | 4 |

**Use the equations below to answer questions 6-9.**

$f(x) = x + 1$ $g(x) = x^2 + 2$ $h(x) = x^3 + 3$

6. Find $f(x) + g(x)$

$x+1+x^2+2$

$x^2+x+3$

7. Find $f(x) - g(x)$

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

$x+1-x^2-2$

$x^2+x-1$

8. Find $f(x) \cdot g(x)$

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

$x^3+2x+x^2+2$

$x^3+x^2+2x+2$

9. Find $f(x)[h(x) + g(x)]$

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

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

$x^4+x^3+5x+x^3+x^2+5$

$x^4+2x^3+x^2+5x+5$

**Solve for x for questions 10-12.**

10. $9x^2 - 25 = 0$

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

$x = \frac{5}{3}, -\frac{5}{3}$

11. $x^2 + 4x = -3$

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

$(x+3)(x+1)$

$x=-3,-1$

12. $(x+4)(x-3)(x+1) = 0$

$x=-4,+3,-1$

13. Write a polynomial in **factored form** that has a leading coefficient of 2, and the following roots: -1, 2, -3.

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

14. Write a polynomial in **standard form** that has a leading coefficient of 2, and the following roots: -1, 2, -3.

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

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

$2x^3+2x^2-12x+2x^2+2x-12$

$2x^3+4x^2-10x-12$

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

0 1 2 3 4 5

$(x+y)^n = x^n y^0 + x^{n-1} y^{0+1} + \dots$

**Use the binomial expansion and Pascal's triangle to solve questions 15-16.**

15. What is the third term in the expansion of $(x+7)^4$?

$x=x$, $y=7$, $n=4$

$6x^2y^2$

$6x^2(7^2)$

$294x^2$

16. What is the second term in the expansion of $(2+y)^3$?

$x=2$, $y=y$, $n=3$

$3x^2y^1$

$3x^2$

**17. Write a polynomial in factored form and standard form with a leading coefficient of -3, and the following roots: 4, 2i, and -2.**

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

$(-3x+12)(x^2+4)$

$-3x^3-12x+12x^2+48$

$-3x^3+12x^2-12x+48$

typo!

**For 18-19: Use the Remainder Theorem to determine if the following are roots of the given polynomial or not; state the remainder.**

18. $(x^3+3x^2-59x+30) \div (x-6)$

$6^3+3\cdot6^2-59\cdot6+30=0$

factor; R=0

19. $(n^3+n^2-28n+28); f(-4)$

$(-4)^3+(-4)^2-28(-4)+28=92$

not factor; R=92

typo!

**For 20-21: Divide the following polynomials.**

20. $(3n^3-16n^2+20n-4) \div (3n-1)$

$n^2-5n+5$ R $1$

$3n-1 \overline{)3n^3-16n^2+20n-4}$

$-(3n^3-n^2)$

$-15n^2+20n$

$-(-15n^2+5n)$

$15n-4$

$-(15n-5)$

$1$

$n^2-5n+5+\frac{1}{3n-1}$

21. $(p^3+3p^2+2) \div (p+3)$

$p^2$

$p+3 \overline{)p^3+3p^2+0p+2}$

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

$0+0+2$

$p^2+\frac{2}{p+3}$

**Using the rational root theorem, factor the following polynomials completely and state both the real and complex roots.**

22. $x^3+9x^2+15x+7=0$

p: 7, 1

q: 1

$\pm\{7,1\}$

$f(1)=896$

$f(-7)=0$

$f(-1)=0$

$f(1)=32$

$x^2+8x+7 \longrightarrow (x+1)(x^2+8x+7)$

$x+1 \overline{)x^3+9x^2+15x+7}$

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

$8x^2+15x$

$-(8x^2+8x)$

$7x+7$

$-(7x+7)$

$0$

$(x+1)(x+1)(x+7)$

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

Real roots: $-1$ (mult: 2), $-7$

NO complex roots

23. $x^4+3x^2-40=0$

$\frac{p}{q}: \pm\{1,2,4,5,8,10,20,40\}$

p: 40 → 1, 2, 4, 5, 8, 10, 20, 40

q: 1 → 1

$f(1)=-36$

$f(-1)=-36$

$f(2)=-12$

$f(-2)=-12$

$f(4)=264$

$f(-4)=264$

$f(5)=660$

$f(-5)=660$

$f(8)=4248$

$f(-8)=$ not working

$(x^2+8)(x^2-5)$

$(x+2i\sqrt{2})(x-2i\sqrt{2})(x+\sqrt{5})(x-\sqrt{5})$

Real roots: $\sqrt{5}, -\sqrt{5}$

Complex roots: $2i\sqrt{2}, -2i\sqrt{2}$

**Graph the following functions, make sure to label all points clearly.**

22. $f(x) = (x+2)^2(x-3)^2$

4.9

Degree of function: 4

Even or odd degree: even

Positive or negative leading coefficient:

pos

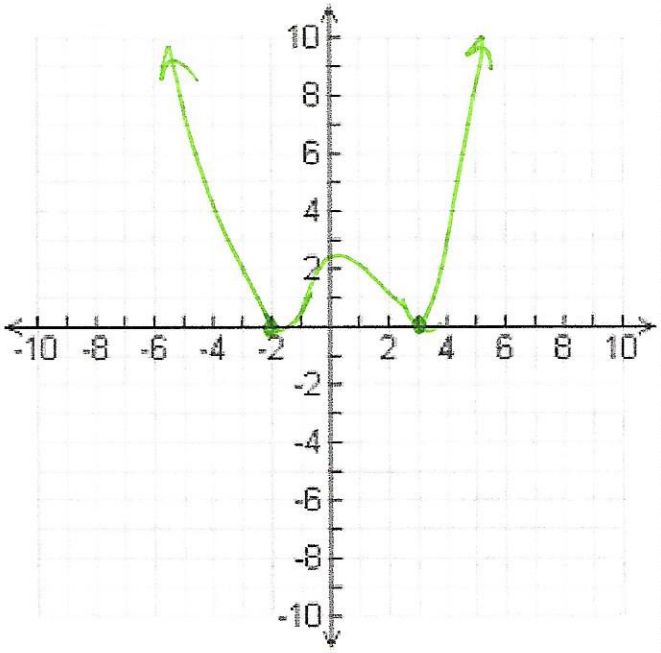
End Behavior:

As $x \to -\infty, f(x) \to$ $\infty$.

As $x \to \infty, f(x) \to$ $\infty$.

Roots, including multiplicity:

$-2$ m:2 $3$ m:2




23. $f(x) = -(x-4)^4(x-1)^2$

Degree of function: 6

Even or odd degree: even

Positive or negative leading coefficient:

neg

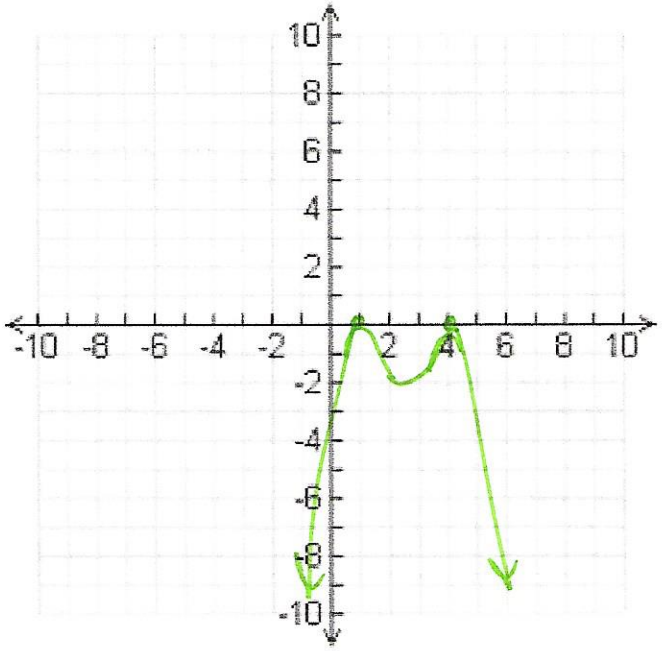
End Behavior:

As $x \to -\infty, f(x) \to$ $-\infty$.

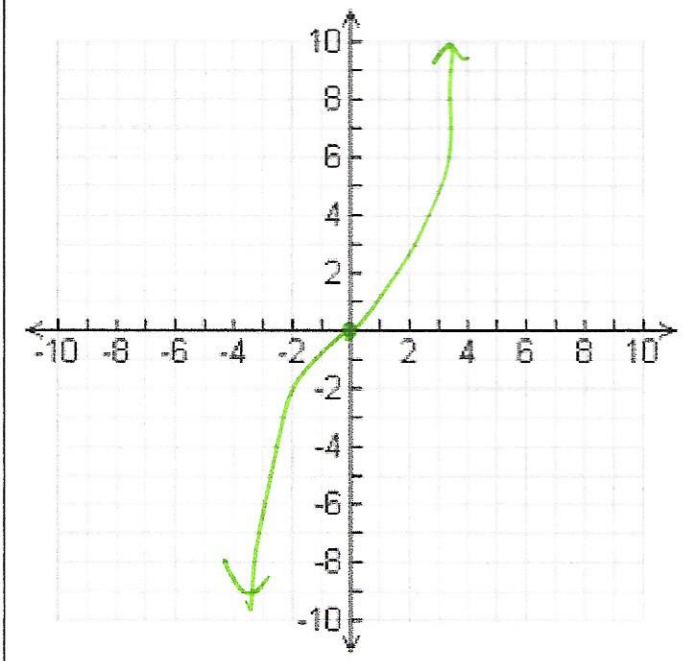
As $x \to \infty, f(x) \to$ $-\infty$.

Roots, including multiplicity:

4 m:4 ; 1 m:2



24. $f(x) = x(x^2 + 4)$




Degree of function: 3

Even or odd degree: odd

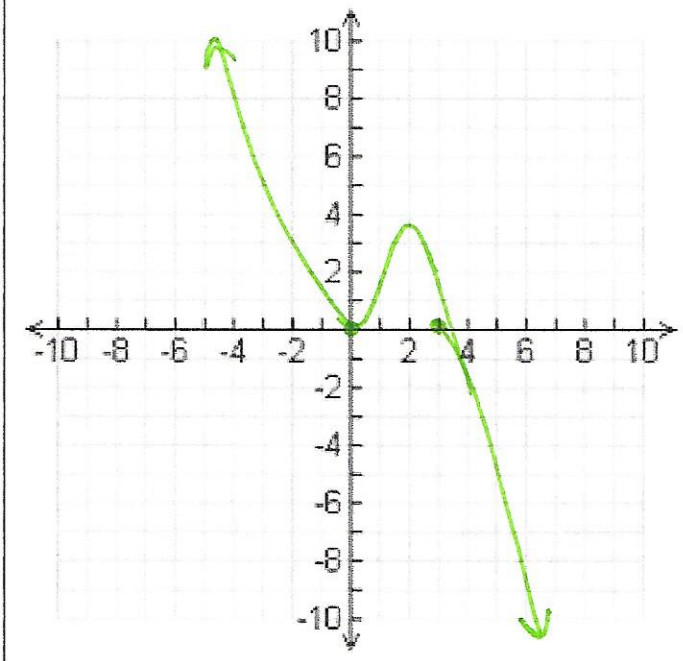
Positive or negative leading coefficient:
pos

End Behavior:
As $x \to -\infty, f(x) \to$ $-\infty$.
As $x \to \infty, f(x) \to$ $\infty$.

Roots, including multiplicity:
0, 2i, -2i
m:1 m:1 m:1

**NO CALCULATOR ALLOWED.**

25. $f(x) = -x^2(x-3)^3$




Degree of function: 5

Even or odd degree: odd

Positive or negative leading coefficient:
neg

End Behavior:
As $x \to -\infty, f(x) \to$ $\infty$.
As $x \to \infty, f(x) \to$ $-\infty$.

Roots, including multiplicity:
0 m:2 ; 3 m:3