Name _____ Date _____ Period _____

Simplify each expression by adding, subtracting, or multiplying. Show work!

1. $(3x^2 - 4x + 1) + (2x^3 + x^2 - x - 4)$

2. $(-x^2 - 4x - 2) - (2x^3 + 3x^2 - x - 1)$

3. $(4x - 3)(x^3 + 3x^2 - x - 1)$

4. $(x + 5)(2x - 1) - (3x^2 - 16x + 3)$

Multiply the expression using the polynomial identities, if possible. Show work!

5. $(3x + 2y)^2$

6. $(x - 2y)^3$

7. $(x - 4)(x + 6)$

8. $(5x + 1)(5x - 1)$

Factor the expressions using the polynomial identities, if possible. Show work!

9. $16x^2 - 49$

10. $x^3 + 125$

11. $x^2 - 4x - 21$

12. $9x^2 - 81$

Use the Remainder Theorem to determine which of the following is a factor? Show work!

13. $x^3 - 3x^2 - x + 3$

    a. $x + 1$

    b. $x - 2$

Use the Remainder Theorem to determine which of the following is a solution? Show work!

14. $2x^3 + x^2 - 5x + 2$

    a) $x = -3$

    b) $x = 1$

Describe the end behavior of each polynomial using limit notation. Write your own limit notation on 17 and 18.

15. $f(x) = (x+3)(x-1)(2x-5)$

$\lim\limits_{x \to +\infty} f(x) = $ $\lim\limits_{x \to -\infty} f(x) = $
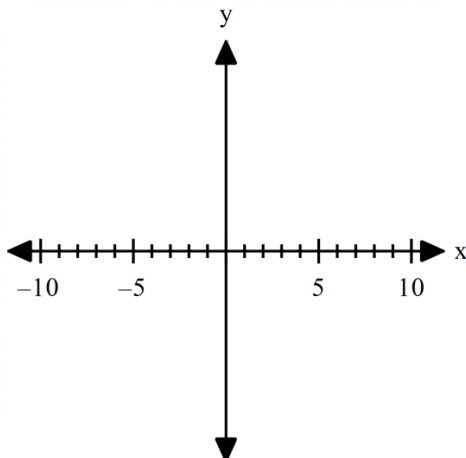
16. $f(x) = -(x+4)^2(x-2)$

$\lim\limits_{x \to +\infty} f(x) = $ $\lim\limits_{x \to -\infty} f(x) = $

17. $f(x) = -2x^3 - 3x^2 + 36x - 58$

18. $f(x) = 3x^4 - 7x^3 + 16x^2 - 15x + 65$

State the degree and list the zeros of the polynomial. State the multiplicity of each zero and determine whether the graph crosses or touches the *x*-axis at the corresponding *x*-intercept. Then sketch a graph.

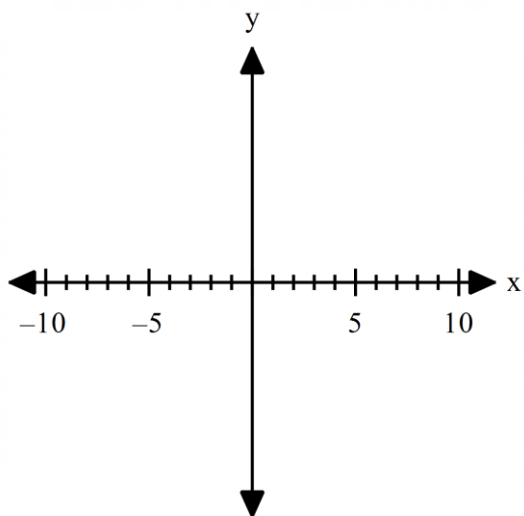19. $f(x) = -2x^3(x+8)$ Degree: _____

Zero	Multiplicity	Touch/Cross

$\lim\limits_{x \to -\infty} f(x) = $ $\lim\limits_{x \to +\infty} f(x) = $

20. $f(x)=(x+1)^2(x-5)^3(x+3)^2$ Degree: _____

Zero	Multiplicity	Touch/Cross

$$\lim_{x\to-\infty} f(x)=\qquad\qquad \lim_{x\to+\infty} f(x)=$$

21. Graph the given polynomial function using a graphing calculator and then find the following:

$f(x)=-x^3+3x^2+x-3$ **Zeros** (write as ordered pairs): _____

y-intercept (write as an ordered pair): _____

End Behavior (write in limit notation): _____

Divide using long division.

22. $(2x^3+7x^2-13x-3)\div(2x-3)$

Divide using synthetic division.

23. $(2x^3-7x^2+11)\div(x-3)$