Name_____

Date _____ Period _____

Solve the following quadratics by FACTORING:

1. $x^2 = 7x + 18$

$x^2 - 7x - 18 = 0$

$(x-9)(x+2) = 0$

$\boxed{x = 9, -2}$

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

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

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

$\boxed{x = \pm 2i, \pm 1}$

3. $2x^3 - 7x = 13x^2$

$\frac{-14}{-14} \diagdown \frac{1}{-13}$

$2x^3 - 13x^2 - 7x = 0$

$x(2x^2 - 13x - 7) = 0$

$(2x^2 - 14x) + (x - 7)$

$2x(x-7) \ 1 \ (x-7)$

$x(2x+1)(x-7) = 0$

$\boxed{x = 0, -\tfrac{1}{2}, 7}$

4. $-4x = 25x^3 + 20x^2$

$25x^3 + 20x^2 + 4x = 0$

$x(25x^2 + 20x + 4) = 0$

$x(5x+2)^2 = 0$

$\boxed{x = 0, -2/5 \text{ mult. of } 2}$

Simplify. Write the polynomial in standard form. Identify the leading coefficient, degree, and name the polynomial

5) $(-5x^3 - 6x^2 + 8x) - 2(-5x + 2x^2 - 12)$ $-5x^3 - 6x^2 + 8x + 10x - 4x^2 + 24$

Standard Form: $-5x^3 - 10x^2 + 18x + 24$ D: 3 LC: -5

Name: Cubic polynomial

Multiply the following polynomials.

6) $3x(x-5)(3x-2)$

$(3x^2 - 15x)(3x-2)$

$9x^3 - 6x^2 - 45x^2 + 30x$

$\boxed{9x^3 - 51x^2 + 30x}$

7) $-(6x - x^2 + 3)(4x + 1)^2$ $(4x+1)(4x+1)$

$(-6x + x^2 - 3)(16x^2 + 8x + 1)$

	$16x^4$	$8x^3$	x^2
x^2	$16x^4$	$8x^3$	x^2
$-6x$	$-96x^3$	$-48x^2$	$-6x$
-3	$-48x^2$	$-24x$	-3

$\boxed{16x^4 - 88x^3 - 95x^2 - 30x - 3}$

Expand the expressions.

8) $(4x - 3)^4$

1 $(4x)^4$ $3^0 = 256x^4$
4 $(4x)^3$ $3^1 = 768x^3$
6 $(4x)^2$ $3^2 = 864x^2$
4 $(4x)^1$ $3^3 = 432x$
1 $(4x)^0$ $3^4 = 81$

$\boxed{256x^4 - 768x^3 + 864x^2 - 432x + 81}$

9) $(2x + 5y)^5$

1 $(2x)^5$ $(5y)^0 = 32x^5$
5 $(2x)^4$ $(5y)^1 = 400x^4 y$
10 $(2x)^3$ $(5y)^2 = 2000x^3 y^2$
10 $(2x)^2$ $(5y)^3 = 5000x^2 y^3$
5 $(2x)^1$ $(5y)^4 = 6250xy^4$
1 $(2x)^0$ $(5y)^5 = 3125y^5$

$\boxed{32x^5 + 400x^4 y + 2000x^3 y^2 + 5000x^2 y^3 + 6250xy^4 + 3125y^5}$

10) A coin is flipped 12 times. What is the probability of getting at least 10 heads?

$$P(10) = {}_{12}C_{10}(.5)^{10}(.5)^2 = .0161$$
$$P(11) = {}_{12}C_{11}(.5)^{11}(.5)^1 = .0029 \qquad = \boxed{.01924}$$
$$P(12) = {}_{12}C_{12}(.5)^{12}(.5)^0 = .00024$$

11) You just took your chemistry benchmark. Each question had 4 answer choices. What is the probability you got exactly 17 of the 20 questions correct?

$$P(17) = {}_{20}C_{17}(.25)^{17}(.75)^3 = \boxed{.000000028}$$

12) Everyone in your math class of 10 students has taken the driving test. The average passing rate is 78%. What is the probability that more than 2 classmates passed the test?

$$P(0) = {}_{10}C_0(.78)^0(.22)^{10} = .0000002666$$
$$P(1) = {}_{10}C_1(.78)^1(.22)^9 = .000009417$$
$$P(2) = {}_{10}C_2(.78)^2(.22)^8 = .000150239$$
$$1 - \overline{.00015992\,22} = \boxed{.99984}$$

13) You visit 9 colleges during your Junior Year Spring Break. The chance of you being accepted at these prestigious universities is 37%. What is the probability you are accepted to either 4 or 5 universities?

$$P(4) = {}_9C_4(.37)^4(.63)^5 = .23436$$
$$P(5) = {}_9C_5(.37)^5(.63)^4 = \underline{.13764}$$
$$\boxed{.372}$$

14) Simplify $(2 - 3x)(3x^2 - 2x - 1)$

-3x	$-9x^3$	$6x^2$	$3x$
2	$6x^2$	$-4x$	-2

$$\boxed{-9x^3 + 12x^2 - x - 2}$$

15) Factor completely: $-16x^4 - 54x$

$$-2x(8x^3 + 27)$$
$$a = 2x \qquad b = 3$$
$$\boxed{-2x(2x+3)(4x^2 - 6x + 9)}$$

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

$$x^3 - x^2 + 3x + 3x^2 - 2x + 3$$
$$\boxed{x^3 + 2x^2 + x + 3}$$

17) Which binomial is a factor of the polynomial $3x^4 + 6x^3 - 5x - 10$?

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

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

A. $(x + 4)$ B. $(x - 2)$ C. $(x + 2)$ D. $(x - 4)$

18) Find the zeros of the function. $f(x) = 4x^4 - 10x^3 + 4x^2$

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

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

$2x(x-2) - 1(x-2)$

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

$x = 0$ mult. of 2, $1/2$, 2

19) Find the product $2cd^4(-4c^6d^5 - c^3d)$

$-8c^7d^9 - 2c^4d^5$

20) Divide $(6x^3 + 5x - 8) \div (x - 2)$

$$2 \underline{|6 \quad 0 \quad 5 \quad -8}$$
$$\downarrow \quad 12 \quad 24 \quad 58$$
$$6 \quad 12 \quad 29 \quad |50$$

$6x^2 + 12x + 29 + \dfrac{50}{x-2}$

21) Factor $x^3 + 5x^2 - 9x - 45$

$x^2(x+5) - 9(x+5)$

$(x^2 - 9)(x+5)$

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

22) Factor the expression $81x^6 + 24x^3y^3$

$3x^3(27x^3 + 8y^3)$

$a = 3x \quad b = 2y$

$3x^3(3x + 2y)(9x^2 - 6xy + 4y^2)$

23) Write the simplest polynomial function with zeros 5, -4, and $\sqrt{2}$ →

$x = \sqrt{2}^2$

$x^2 = 2$

$x^2 - 2$

$(x-5)(x+4)(x^2-2) = 0$

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

	x^3	$4x^2$	$-2x$	-8
x	x^4	$4x^3$	$-2x^2$	$-8x$
-5	$-5x^3$	$-20x^2$	$10x$	40

$x^4 - x^3 - 22x^2 + 2x + 40 = 0$

24) After studying a couple's family history, a doctor determines that the probability of any child born to this couple having a gene for disease X is 1 out of 4. If the couple has three children, what is the probability that at least two of the children have the gene for disease X?

$$P(2) = {}_3C_2(.25)^2(.75)^1 = .140625$$

$$P(3) = {}_3C_3(.25)^3(.75)^0 = .015625$$

$$\boxed{.15625}$$

25) Find roots of the polynomial function $f(x) = x^3 + 3x^2 - 10x + 6$

$$\begin{array}{c|cccc} 1 & 1 & 3 & -10 & 6 \\ & \downarrow & 1 & 4 & -6 \\ \hline & 1 & 4 & -6 & \underline{0} \end{array}$$

$$x^2 + 4x - 6 = 0$$

$$x^2 + 4x + \underline{4} = 6 + \underline{4}$$

$$\sqrt{(x+2)^2} = \sqrt{10}$$

$$x + 2 = \pm\sqrt{10}$$

$$\boxed{x = -2 \pm \sqrt{10}, 1}$$

26) $(2x+3)^2(x-1)^2$

$$(4x^2 + 12x + 9)(x^2 - 2x + 1)$$

	$4x^2$	$-8x^3$	$4x^2$
$4x^2$	$4x^4$	$-8x^3$	$4x^2$
$12x$	$12x^3$	$-24x^2$	$12x$
9	$9x^2$	$-18x$	9

$$\boxed{4x^4 + 4x^3 - 11x^2 - 6x + 9}$$

27) How do you name polynomials based on the degree? Consider degrees of 0, 1, 2, 3, 4, 5

$0 \rightarrow$ constant

$1 \rightarrow$ linear

$2 \rightarrow$ quadratic

$3 \rightarrow$ cubic

$4 \rightarrow$ quartic

$5 \rightarrow$ quintic

Factor completely.

28) $-12x^4 + 10x^3 + 8x^2$

$$-2x^2(6x^2 - 5x - 4)$$

$$(6x^2 - 8x) + (3x - 4)$$

$$2x(3x-4) \; 1(3x-4)$$

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

$$\frac{-24}{-8}\diagdown\frac{3}{-5}$$

29) $81a^2b^8 - 100c^{22}$

$$\boxed{(9ab^4 + 10c^{11})(9ab^4 - 10c^{11})}$$

30) $81a^2b^4 - 121c^{18}$

$$\boxed{(9ab^2 + 11c^9)(9ab^2 - 11c^9)}$$

31) $(3x^5 + 2x^3 - 81x^2 - 54)$

$$x^3(3x^2 + 2) - 27(3x^2 + 2)$$

$$(x^3 - 27)(3x^2 + 2)$$

$$\boxed{(x-3)(x^2 + 3x + 9)(3x^2 + 2)}$$

32) $40x^6 - 135x^3$

$5x^3(8x^3 - 27)$

$\boxed{5x^3(2x-3)(4x^2+6x+9)}$

33) $6x^7 - 6x$

$6x(x^6 - 1)$

$6x^3(x^3+1)(x^3-1)$

$\boxed{6x^3(x+1)(x^2-x+1)(x-1)(x^2+x+1)}$

34) $-3x^{13} + 21x^9 + 54x^5$

$-3x^5(x^8 - 7x^4 - 18)$

$-3x^5(x^4-9)(x^4+2)$

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

35) $(2x^{10} + 3x^8)(-32x^6 - 48x^4)$

$\boxed{x^4}(2x^6 + 3x^4 - 32x^2 - 48)$

$x^4(2x^2+3) - 16(2x^2+3)$

$x^4(x^4-16)(2x^2+3)$

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

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

36) $x^4 - 3x^2 - 18$

$\boxed{(x^2-6)(x^2+3)}$

Divide the following polynomials by the method of your choice.

37) $(-8x^4 + 12x^2 - x - 1) \div (2x - 3)$

$$\begin{array}{r} -4x^3 - 6x^2 - 3x - 5 \\ 2x-3 \overline{)-8x^4 + 0x^3 + 12x^2 - x - 1} \\ +8x^4 \mp 12x^3 \\ \hline -12x^3 + 12x^2 \\ +12x^3 \mp 18x^2 \\ \hline -6x^2 - x \\ +6x^2 \mp 9x \\ \hline -10x - 1 \\ +10x \mp 15 \\ \hline -16 \end{array}$$

$\boxed{-4x^3 - 6x^2 - 3x - 5 + \dfrac{-16}{2x-3}}$

1) $(x^5 - 3x^4 - 70x^3 - 7x + 79) \div (x - 10)$

$\begin{array}{r|rrrrrr} 10 & 1 & -3 & -70 & 0 & -7 & 79 \\ & & 10 & 70 & 0 & 0 & -70 \\ \hline & 1 & 7 & 0 & 0 & -7 & 9 \end{array}$

$\boxed{x^4 + 7x^3 - 7 + \dfrac{9}{x-10}}$

2) $(p^4 - 10p^3 + 6p - 68) \div (p - 10)$

$\begin{array}{r|rrrrr} 10 & 1 & -10 & 0 & 6 & -68 \\ & & 10 & 0 & 0 & 60 \\ \hline & 1 & 0 & 0 & 6 & -8 \end{array}$

$\boxed{p^4 + 6 + \dfrac{-8}{p-10}}$

List the possible rational roots of the following function

40) $f(x) = 2x^4 - x^3 + 23x^2 - 25x - 10$

$$\frac{p}{q} = \frac{\pm\{1,2,5,10\}}{\pm\{1,2\}} = \boxed{\pm\{1, \tfrac{1}{2}, 2, 5, \tfrac{5}{2}, 10\}}$$

41) Solve for the zeros of $f(x) = x^3 - 6x^2 + 49x - 294$

$$\underline{6}\,|\,\begin{array}{cccc} 1 & -6 & 49 & -294 \\ & 6 & 0 & 294 \\ \hline 1 & 0 & 49 & \underline{0} \end{array}$$

$x^2 + 49 = 0$

$x^2 = -49$

$\boxed{x = \pm 7i, 6}$

42) Find the roots $f(x) = x^4 - 4x^3 + 20x^2 - 64x + 64$

$$\underline{2}\,|\,\begin{array}{ccccc} 1 & -4 & 20 & -64 & 64 \\ & 2 & -4 & 32 & -64 \\ \hline 1 & -2 & 16 & -32 & \underline{0} \end{array}$$

$(x^3 - 2x^2) + (16x - 32)$

$x^2(x-2) \quad 16(x-2)$

$(x^2 + 16)(x-2)$

$\boxed{x = \pm 4i, 2 \text{ mult. of } 2}$

Write a polynomial function with the given zeros.

43) $1 + 4i, \tfrac{3}{2}$

$X = 1+4i$

$(x-1)^2 = (4i)^2$

$x^2 - 2x + 1 = 16i^2$

$(x^2 - 2x + 17)(2x - 3)$

$x^2 - 2x + 17$

| $2x$ | $2x^3$ | $-4x^2$ | $34x$ |
| -3 | $-3x^2$ | $6x$ | -51 |

$\boxed{2x^3 - 7x^2 + 40x - 51 = 0}$

44) $-3 - \sqrt{3}, 2$

$x = -3 - \sqrt{3}$

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

$x^2 + 6x + 9 = 3$

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

$x^2 + 6x + 6$

| x | x^3 | $6x^2$ | $6x$ |
| -2 | $-2x^2$ | $-12x$ | -12 |

$\boxed{x^3 + 4x^2 - 6x - 12 = 0}$

45) $x = \tfrac{-1}{2}, 0, -4$

$x(2x+1)(x+4) = 0$

$(2x^2 + x)(x + 4) = 0$

$\boxed{2x^3 + 9x^2 + 4x = 0}$

46) $x = 0 \text{ mult of } 3, \tfrac{4}{5} \text{ mult of } 2$

$x^3(5x-4)(5x-4) = 0$

$x^3(25x^2 - 40x + 16)$

$\boxed{25x^5 - 40x^4 + 16x^3 = 0}$