Algebra 2 Unit 3 Review Name:_____

Factor. Sum/Dif of Cubes | Dif. of Squares | Rewrite middle term | Grouping

1. $x^3 - 64$ a=x b=4
$(x-4)(x^2+4x+16)$

2. 1. $x^2 - 36$
$(x+6)(x-6)$

3. $2x^2 - x - 6$ +group
$(2x+3)(x-2)$

4. $p^3 + 4p^2 - 9p - 36$
$p^2(p+4) - 9(p+4)$
$(p^2-9)(p+4)$
$(p+3)(p-3)(p+4)$

Find the possible rational zeros of the function.

5. $f(x) = 5x^5 - 4x^3 + 2x - 45$ (Q, P)
p: $\pm1, \pm3, \pm5, \pm9, \pm15, \pm45$
q: $\pm1, \pm5$
P/q = $\pm1, \pm3, \pm5, \pm9, \pm15, \pm45, \pm\frac{1}{5}, \pm\frac{3}{5}, \pm\frac{9}{5}$

6. $f(x) = 3x^4 - 5x^3 + 2x - 8$
p: $\pm1, \pm2, \pm4, \pm8$
q: $\pm1, \pm3$
P/q = $\pm1, \pm2, \pm4, \pm8, \pm\frac{1}{3}, \pm\frac{2}{3}, \pm\frac{4}{3}, \pm\frac{8}{3}$

Divide using synthetic division.

7. $f(x) = 2x^3 - x^2 - 7x + 6 \div (x+2)$
$-2 \mid 2 \; -1 \; -7 \; 6$
$\quad\quad\downarrow \; -4 \; 10 \; -6$
$\quad 2 \; -5 \; 3 \; : 0$
$2x^2 - 5x + 3$

8. $f(x) = x^4 - 2x^3 + 44x + 7 \div (x-3)$
$3 \mid 1 \; -2 \; 0 \; 44 \; 7$
$\quad\quad\downarrow \; 3 \; 3 \; 9 \; 159$
$\quad 1 \; 1 \; 3 \; 53 \; : 166$
$x^3 + x^2 + 3x + 53 + \frac{166}{x-3}$

9. Is $(x-2)$ a factor of the function $f(x) = 3x^3 - 2x + 4$? Use synthetic division to explain.
$2 \mid 3 \; 0 \; -2 \; 4$
$\quad\quad\downarrow \; 6 \; 12 \; 20$
$\quad 3 \; 6 \; 10 \; : 24$
no. There is a remainder.

10. One factor of $x^3 - 4x^2 + x + 6$ is $(x-3)$. Find the other factors.
$3 \mid 1 \; -4 \; 1 \; 6$
$\quad\quad\downarrow \; 3 \; -3 \; -6$
$\quad 1 \; -1 \; -2 \; : 0$
$x^2 - x - 2$
$(x-2)(x+1)$

11. When we say that the root $x = 7$ has a "multiplicity of 2," what do we mean?
x=7 is a root twice + the graph would bounce off the x-axis at 7

Find all zeros of the function.

12. $f(x) = x^3 + x^2 - 4x - 4$ P/q = $\pm1, \pm2, \pm4$
x = -1, 2, -2 (calc)
you could also factor this one + solve

13. $f(x) = 4x^3 - 3x^2 + 4x - 3$
p: $\pm1, \pm3$
q: $\pm1, \pm2, \pm4$
P/q = $\pm1, \pm3, \pm\frac{1}{2}, \pm\frac{1}{3}, \pm\frac{3}{2}, \pm\frac{3}{4}$
x = 3/4 (calc)
$\frac{3}{4} \mid 4 \; -3 \; 4 \; -3$
$\quad\quad\downarrow \; 3 \; 0 \; 3$
$\quad 4 \; 0 \; 4 \; : 0$
$4x^2 + 4 = 0$
$4x^2 = -4$
$x^2 = -1$
$x = \pm\sqrt{-1} = \pm i$
$x = \frac{3}{4}, \pm i$

14. $f(x) = x^4 + 4x^3 + 3x^2 - 4x - 4$
P/q = $\pm1, \pm2, \pm4$
x = 1, -1, -2 with multiplicity of 2

15. $f(x) = x^4 - 4x^3 + x^2 + 16x - 20$
P/q = $\pm1, \pm2, \pm4, \pm5, \pm10, \pm20$
x = 2, -2 (calc)
$2 \mid 1 \; -4 \; 1 \; 16 \; -20$
$\quad\quad\downarrow \; 2 \; -4 \; -6 \; 20$
$-2 \mid 1 \; -2 \; -3 \; 10 \; : 0$
$\quad\quad\downarrow \; -2 \; 8 \; -10$
$\quad 1 \; -4 \; 5 \; : 0$
$x^2 - 4x + 5$
$\frac{4 \pm \sqrt{(-4)^2 - 4(1)(5)}}{2(1)}$
$\frac{4 \pm \sqrt{-4}}{2} = \frac{4 \pm 2i}{2} = 2 \pm i$

16. A polynomial function has the given zeros: $2 - \sqrt{3}$, $4i$. What are the missing zeros?
$2 + \sqrt{3}$ and $-4i$

Write a polynomial function of least degree that has the given zeros.

17. -1, 3, & 5 $(x+1)(x-3)(x-5)$
$f(x) = (x+1)(x^2 - 8x + 15)$
$f(x) = x^3 - 8x^2 + 15x + 1x^2 - 8x + 15$
$f(x) = x^3 - 7x^2 + 7x + 15$

18. -1 (multiplicity 2) & i $(x-1)(x-1)(x+i)(x-i)$
$f(x) = (x^2 - 2x + 1)(x^2 + 1)$
$f(x) = x^4 + x^2 - 2x^3 - 2x + x^2 + 1$
$f(x) = x^4 - 2x^3 + 2x^2 - 2x + 1$

19. -2 & $4i$ $(x+2)(x-4i)(x+4i)$
$f(x) = (x+2)(x^2 - 16i^2)$ $*i^2 = -1$
$f(x) = (x+2)(x^2 + 16)$
$f(x) = x^3 + 2x^2 + 16x + 32$

20. $-3, 3, -2i, 2i$
$f(x) = (x+3)(x-3)(x+2i)(x-2i)$
$f(x) = (x^2 - 9)(x^2 - 4i^2)$
$f(x) = (x^2 - 9)(x^2 + 4)$
$f(x) = x^4 - 5x^2 - 36$

Algebra 2 Polynomial Review #2 Name:_____

1. Is $(x+1)$ a factor of x^3+2x^2-5x-6? How can you decide?

$x+1=0$, $x=-1$

$-1 \mid 1\ 2\ -5\ -6$; $\downarrow\ -1\ -1\ 6$; $1\ 1\ -6 : 0$

yes; the remainder is 0.

2. Is $(x+2)$ a factor of $x^4-x^3-11x^2+9x+18$? How can you decide?

$x+2=0$, $x=-2$

$-2 \mid 1\ -1\ -11\ 9\ 18$; $\downarrow\ -2\ 6\ 10\ -38$; $1\ -3\ -5\ 19 : -20$

no; there is a remainder.

3. Given $x=2$, find all FACTORS of the polynomial function $f(x)=4x^4-4x^3-9x^2+x+2$.

$2 \mid 4\ -4\ -9\ 1\ 2$; $\downarrow\ 8\ 8\ -2\ -2$; $4\ 4\ -1\ -1 : 0$

$4x^3+4x^2-x-1=0$

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

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

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

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

(given)

4. Given $x=4$, find all ROOTS of the polynomial function $g(x)=x^3-64$.

$4 \mid 1\ 0\ 0\ -64$; $\downarrow\ 4\ 16\ 64$; $1\ 4\ 16 : 0$

$x^2+4x+16=0$

$x=\frac{-4\pm\sqrt{(4)^2-4(1)(16)}}{2(1)}$

$x=\frac{-4\pm\sqrt{-48}}{2}=\frac{-4\pm4i\sqrt{3}}{2}=-2\pm2i\sqrt{3}$

(given) $+4$

5. Given $x=-3$, find all ZEROS of the polynomial function $h(x)=x^4+x^3-2x^2+4x-24$.

$-3 \mid 1\ 1\ -2\ 4\ -24$; $\downarrow\ -3\ 6\ -12\ 24$; $1\ -2\ 4\ -8 : 0$

$x^3-2x^2+4x-8=0$

$(x^3-2x^2)+(4x-8)=0$

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

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

$x^2+4=0$, $x^2=-4$, $x=\pm\sqrt{-4}$, $x=\pm2i$

$x-2=0$, $x=2$

$x=3$ (given)

6. Find all zeros of the polynomial function $f(x)=x^4-x^3+7x^2-9x-18$.

$P/q=\pm1,\pm2,\pm3,\pm6,\pm9,\pm18$

calc: $x=-1,2$

$-1 \mid 1\ -1\ 7\ -9\ -18$; $\downarrow\ -1\ 2\ -9\ 18$

$2 \mid 1\ -2\ 9\ -18 : 0$; $\downarrow\ 2\ 0\ 18$; $1\ 0\ 9 : 0$

$x^2+9=0$, $x^2=-9$, $x=\pm\sqrt{-9}$, $x=\pm3i, -1, 2$

7. Find all roots of the polynomial function $h(x)=x^3+x^2-29x-5$.

$P/q=\pm1,\pm5$

calc: $x=5$

$5 \mid 1\ 1\ -29\ -5$; $\downarrow\ 5\ 30\ 5$; $1\ 6\ 1 : 0$

$x^2+6x+1=0$

$x=\frac{-6\pm\sqrt{(6)^2-4(1)(1)}}{2(1)}$

$x=\frac{-6\pm\sqrt{32}}{2}=\frac{-6\pm4\sqrt{2}}{2}=-3\pm2\sqrt{2}$

$+5$

8. Given the function $g(x)=x(x-3)(x+5)^2$

a. What does $(x+5)^2$ indicate about the root(s)? $x=-5$ has a multiplicity of 2 (double root)

b. Find all x-intercepts. $x=0, x=3, x=-5$ (twice)

c. What is the degree of the polynomial function? 4