Unit 1B Review **CCGPS Advanced Algebra**

Factor:

1. $x^3 - 64$
2. $x^2 - 36$
3. $2x^2 - x - 6$
4. $p^3 + 4p^2 - 9p - 36$

Find the possible rational zeros of:

5. $f(x) = 5x^5 - 4x^3 + 2x - 45$
6. $f(x) = 3x^4 - 5x^3 + 2x - 8$

Divide using synthetic division.

7. $f(x) = 2x^3 - x^2 - 7x + 6 \div (x+2)$
8. $f(x) = x^4 - 2x^3 + 44x + 7 \div (x - 3)$

9. Is $(x - 2)$ a factor of the function $f(x) = 3x^3 - 2x + 4$? Use synthetic division to explain.

10. One factor of $x^3 - 4x^2 + x + 6$ is $x - 3$. Find the other factors.

11. When we say that the root x=7 has a "multiplicity of 2," what do we mean?

Find all of the zeros of:

12. $f(x) = x^3 + x^2 - 4x - 4$
13. $f(x) = 4x^3 - 3x^2 + 4x - 3$
14. $f(x) = x^4 + 4x^3 + 3x^2 - 4x - 4$
15. $f(x) = x^4 - 4x^3 + x^2 + 16x - 20$

16. Given the zeros: $2 - \sqrt{3}$, $4i$ what are the missing zeros? (Do Not Solve)

Write the polynomial with the following zeros:

17. -1, 3, & 5
18. -1 (with a multiplicity of 2) & i
19. -2 & 4i
20. $3, -3, -2i$

Unit 1B Review

CCGPS Adv. Alg.

① $x^3-64 = \boxed{(x-4)(x^2+4x+16)}$

② $x^2-36 = \boxed{(x-6)(x+6)}$

③ $2x^2-x-6$

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

$(-4)(3) = -12$

$(-4)+(3) = -1$

* OR use grouping

④ $(p^3+4p^2)(-9p-36)$

$p^2(p+4)-9(p+4) =$

$(p^2-9)(p+4) = \boxed{(p+3)(p-3)(p+4)}$

⑤ $f(x) = 5x^5-4x^3+2x-45$

$p =$ constant factors $= \pm 1, 3, 5, 9, 15, 45$

$q =$ leading coef. factors $= \pm 1, 5$

$\boxed{\frac{p}{q} = \pm 1, 3, 5, 9, 15, 45, 1/5, 3/5, 9/5}$

* only list possibles - do not solve.

⑥ $f(x) = 3x^4-5x^3+2x-8$

$p = 8 = \pm 1, 2, 4$

$q = \pm 1, 3$

$\boxed{\frac{p}{q} = \pm 1, 2, 4, 1/3, 2/3, 4/3}$

* only list possibles

⑦
$$\begin{array}{r|rrrr} -2 & 2 & -1 & -7 & 6 \\ & & -4 & 10 & -6 \\ \hline & 2 & -5 & 3 & 0 \end{array} = 2x^2-5x+3$$

⑧
$$\begin{array}{r|rrrrr} 3 & 1 & -2 & 0 & 44 & 7 \\ & & 3 & 3 & 9 & 159 \\ \hline & 1 & 1 & 3 & 53 & 166 \end{array}$$

$$= x^3+x^2+3x+53+\frac{166}{x-3}$$

⑨
$$\begin{array}{r|rrrr} 2 & 3 & 0 & -2 & 4 \\ & & 6 & 12 & 20 \\ \hline & 3 & 6 & 10 & 24 \end{array}$$

$(x-2)$ is not a factor because the remainder does not equal zero.

⑩
$$\begin{array}{r|rrrr} 3 & 1 & -4 & 1 & 6 \\ & & 3 & -3 & -6 \\ \hline & 1 & -1 & -2 & 0 \end{array} = x^2-x-2 = (x-2)(x+1)$$

⑪ We mean that 7 is a root twice. It can also be called a double root. The graph hits the x-axis at 7 and bounces off the axis.

⑫ $\boxed{-2, -1, 2}$ → you can see them all on the graph

(13) - Find p's + q's $p = \pm 1, 3$ $\frac{p}{q} = \pm 1, 3, 1/2, 3/2, 1/4, 3/4$

$q = \pm 1, 2, 4$

- go to table, $3/4$ gives me 0.
- divide by $3/4$

$$\begin{array}{c|cccc} 3/4 & 4 & -3 & 4 & -3 \\ & & 3 & 0 & 3 \\ \hline & 4 & 0 & 4 & 0 \end{array}$$

$4x^2 + 4 = 0$

$4x^2 = -4$

$x^2 = -1$

$x = \pm i$

$\boxed{\text{Roots } 3/4, i, -i}$

(14) $\boxed{-2, -2, -1, 1}$ (−2 is a double root or has multiplicity of 2)

(15) 2, −2

$$\begin{array}{c|ccccc} 2 & 1 & -4 & 1 & 16 & -20 \\ & & 2 & -4 & -6 & 20 \\ \hline & 1 & -2 & -3 & 10 & \emptyset \end{array}$$

$$\begin{array}{c|cccc} -2 & 1 & -2 & -3 & 10 \\ & & -2 & 8 & -10 \\ \hline & 1 & -4 & 5 & 0 \end{array}$$

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

$$\frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(5)}}{2(1)} =$$

$$\frac{4 \pm \sqrt{16-20}}{2} = \frac{4 \pm \sqrt{-4}}{2} = \frac{4 \pm 2i}{2}$$

$$= 2 \pm i$$

Roots

$\boxed{2, -2, 2+i, 2-i}$

(16) If $2-\sqrt{3}$ and $4i$ are roots, then $2+\sqrt{3}$ and $-4i$ must also be roots.

(17) Zeros: $-1, 3, 5$

Factors: $(x+1)(x-3)(x-5)$

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

$= (x+1)(x^2-8x+15)$

$= x^3-8x^2+15x+x^2-8x+15$

$= \boxed{x^3-7x^2+7x+15}$

(18) Zeros: $\underbrace{-1, -1}_{\text{multiplicity } 2}, \underbrace{i, -i}_{\text{conjugates}}$ Factors $(x+1)(x+1)(x-i)(x+i)$

$= (x^2+1x+1x+1)(x^2\cancel{+ix}\cancel{-ix}-i^2)$

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

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

$= \boxed{x^4+2x^3+2x^2+2x+1}$

(19) Zeros: $-2, 4i, -4i$

Factors: $(x+2)(x-4i)(x+4i)$

$= (x+2)(x^2+\cancel{4ix}-\cancel{4ix}-16i^2)$

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

$= \boxed{x^3+2x^2+16x+32}$

(20) Zeros: $3, -3, -2i, 2i$

Factors: $(x-3)(x+3)(x+2i)(x-2i)$

$= (x^2\cancel{+3x}\cancel{-3x}-9)(x^2\cancel{-2ix}\cancel{+2ix}-4i^2)$

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

$= x^4+4x^2-9x^2-36$

$= \boxed{x^4-5x^2-36}$