

Name: _____

8.5 Finding Zeros Day 2

1. Given that 3 is a zero of the polynomial $P(x) = x^3 + 2x^2 - 11x - 12$, factor completely

$$\begin{array}{r} 3 | 1 \ 2 \ -11 \ -12 \\ \downarrow \quad 3 \ 15 \ 12 \\ 1 \ 5 \ 4 \ 10 \end{array}$$

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

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

2. Given that 2 is a zero of the polynomial $P(x) = x^3 - 4x^2 - 11x + 30$, factor completely

$$\begin{array}{r} 2 | 1 \ -4 \ -11 \ 30 \\ \downarrow \quad 2 \ -4 \ -30 \\ 1 \ -2 \ -15 \ 10 \end{array}$$

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

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

List all possible rational zeros given by the Rational Zeros Theorem (but don't check to see which actually are zeros)

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

$P: \pm 1, \pm 3$

$Q: \pm 1$

$$\frac{P}{Q}: \boxed{\pm \{1, 3\}}$$

Factor Completely

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

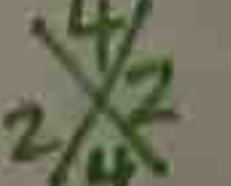
$P: \pm 1, \pm 2, \pm 4$

$Q: \pm 1$

Possible: $\pm \{1, 2, 4\}$

$$\begin{array}{r} 1 \ 1 \ 3 \ 0 \ -4 \\ \downarrow \quad 1 \ 4 \ 4 \ 10 \\ 1 \ 4 \ 4 \ 10 \end{array}$$

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



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

6. $P(x) = x^3 - 3x - 2$

$P: \pm 1, \pm 2$

$Q: \pm 1$

Possible: $\pm \{1, 2\}$

$$\begin{array}{r} 1 \ 1 \ 0 \ -3 \ -2 \\ \downarrow \quad 1 \ 1 \ -2 \\ 1 \ 1 \ -2 \ 10 \end{array}$$

$$\begin{array}{r} (x-2)(x^2+2x+1) \\ \cancel{x-2} \end{array}$$

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

7. $P(x) = x^4 - 2x^3 - 5x^2 + 6x$

$P(x) = x(x^3 - 2x^2 - 5x + 6)$

$P: \pm 1, \pm 2, \pm 3, \pm 6$

$Q: \pm 1$

Possible: $\pm \{1, 2, 3, 6\}$

$$\begin{array}{r} 1 \ 1 \ -2 \ -5 \ 6 \\ \downarrow \quad 1 \ -1 \ -6 \\ 1 \ -1 \ -6 \ 10 \end{array}$$

$$x(x-1)(x^2-x-6)$$

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

Find all real zeros of the polynomial. Use the quadratic formula if necessary

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

$P: \pm 1, \pm 2$

$Q: \pm 1$

Possible: $\pm \{1, 2\}$

$$\begin{array}{r} 1 \ 1 \ 4 \ 3 \ -2 \\ \downarrow \quad 1 \ 5 \ 8 \\ 1 \ 5 \ 8 \ 16 \end{array}$$

⋮

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

doesn't factor... ☹

$a=1 \quad b=2 \quad c=-1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-2 \pm \sqrt{8}}{2} = -1 \pm \sqrt{2}$$

$$\boxed{\{-2, -1 \pm \sqrt{2}\}}$$

9. $P(x) = x^4 - 5x^3 - 5x^2 + 23x + 10$

$P: \pm 1, \pm 2, \pm 5, \pm 10$

$Q: \pm 1$

Possible: $\pm \{1, 2, 5, 10\}$

$$\begin{array}{r} 5 \ 1 \ -5 \ -5 \ 23 \ 10 \\ \downarrow \quad 5 \ 0 \ -25 \ -10 \\ 1 \ 0 \ -5 \ -2 \ 10 \end{array}$$

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

use rational roots again

$P: \pm 1, \pm 2$

$Q: \pm 1$

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

quad form

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{2 \pm \sqrt{8}}{2} = 1 \pm \sqrt{2}$$

$$\boxed{\{5, -2, 1 \pm \sqrt{2}\}}$$