

## Assignment

Date \_\_\_\_\_ Period \_\_\_\_\_

**State the possible rational roots for each equation. Then find all roots.**

1)  $x^3 - 8x^2 + 19x - 14 = 0$

2)  $x^3 - 4x^2 - 24x - 24 = 0$

3)  $x^3 + 10x^2 - 6x - 44 = 0$

4)  $x^3 - 10x^2 + 33x - 34 = 0$

5)  $x^3 - 13x^2 + 23x - 11 = 0$

6)  $x^3 + x^2 - 20x - 50 = 0$

7)  $x^3 + x^2 - 2x - 2 = 0$

8)  $x^3 - 11x^2 - x + 11 = 0$

9)  $x^3 - 3x^2 - x + 3 = 0$

10)  $x^3 + 3x^2 + 7x + 85 = 0$

$$11) x^3 + 10x^2 + 36x + 40 = 0$$

$$12) x^3 - 9x^2 + 15x - 7 = 0$$

$$13) x^3 - 7x^2 + 11x - 5 = 0$$

$$14) x^3 + 5x^2 - 4x - 20 = 0$$

$$15) x^3 + 4x^2 + 6x - 36 = 0$$

$$16) x^3 + 13x^2 + 23x + 11 = 0$$

$$17) x^3 - x^2 - 4x + 4 = 0$$

$$18) x^3 - 7x^2 + 20x - 24 = 0$$

$$19) x^3 - 13x^2 - x + 13 = 0$$

$$20) x^3 - 10x^2 + 41x - 50 = 0$$

$$21) x^3 + x^2 - 5x - 5 = 0$$

$$22) x^3 + 2x^2 + 2x + 4 = 0$$

$$23) x^3 + 10x^2 + 48x + 64 = 0$$

$$24) x^3 - 4x^2 + 5x - 2 = 0$$

$$25) x^3 - 13x^2 + 57x - 85 = 0$$

$$26) x^3 - 11x^2 + 55x - 125 = 0$$

$$27) x^3 + 9x^2 + 15x + 7 = 0$$

$$28) x^3 - 2x^2 - x + 2 = 0$$

$$29) x^3 - 10x^2 + 48x - 64 = 0$$

$$30) x^3 - 3x^2 + x - 3 = 0$$

$$31) x^3 - 5x^2 - 13x - 7 = 0$$

$$32) x^3 + x^2 + 4x + 30 = 0$$

$$33) x^3 - x^2 + x - 1 = 0$$

$$34) x^3 - 3x^2 + 2x - 6 = 0$$

$$35) x^3 - 4x^2 - 36x - 48 = 0$$

$$36) x^3 - 15x^2 + 27x - 13 = 0$$

$$37) x^3 - 2x^2 - 2x + 4 = 0$$

$$38) x^3 + x^2 - 12x + 40 = 0$$

$$39) x^3 - 2x^2 + 5x + 26 = 0$$

$$40) x^3 - 2x^2 + 4x - 8 = 0$$

$$41) x^3 + 11x^2 - x - 11 = 0$$

$$42) x^3 - 3x^2 - 39x + 145 = 0$$

$$43) x^3 - 9x^2 - 21x - 11 = 0$$

$$44) x^3 - x^2 - 5x + 5 = 0$$

$$45) x^3 + 2x^2 - 2x - 4 = 0$$

$$46) x^3 + 5x^2 - x - 5 = 0$$

$$47) x^3 - 2x^2 + 12x + 40 = 0$$

$$48) x^3 + 15x^2 + 27x + 13 = 0$$

$$49) x^3 + 9x^2 - 21x + 11 = 0$$

$$50) x^3 - 4x^2 + x + 26 = 0$$

## Assignment

Date \_\_\_\_\_ Period \_\_\_\_\_

State the possible rational roots for each equation. Then find all roots.

1)  $x^3 - 8x^2 + 19x - 14 = 0$

Possible rational roots:  $\pm 1, \pm 2, \pm 7, \pm 14$ Roots:  $\{2, 3 + \sqrt{2}, 3 - \sqrt{2}\}$ 

2)  $x^3 - 4x^2 - 24x - 24 = 0$

Possible rational roots:

 $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$ Roots:  $\{-2, 3 + \sqrt{21}, 3 - \sqrt{21}\}$ 

3)  $x^3 + 10x^2 - 6x - 44 = 0$

Possible rational roots:

 $\pm 1, \pm 2, \pm 4, \pm 11, \pm 22, \pm 44$ Roots:  $\{-2, -4 + \sqrt{38}, -4 - \sqrt{38}\}$ 

4)  $x^3 - 10x^2 + 33x - 34 = 0$

Possible rational roots:  $\pm 1, \pm 2, \pm 17, \pm 34$ Roots:  $\{2, 4 + i, 4 - i\}$ 

5)  $x^3 - 13x^2 + 23x - 11 = 0$

Possible rational roots:  $\pm 1, \pm 11$ Roots:  $\{1 \text{ mult. } 2, 11\}$ 

6)  $x^3 + x^2 - 20x - 50 = 0$

Possible rational roots:

 $\pm 1, \pm 2, \pm 5, \pm 10, \pm 25, \pm 50$ Roots:  $\{5, -3 + i, -3 - i\}$ 

7)  $x^3 + x^2 - 2x - 2 = 0$

Possible rational roots:  $\pm 1, \pm 2$ Roots:  $\{-1, \sqrt{2}, -\sqrt{2}\}$ 

8)  $x^3 - 11x^2 - x + 11 = 0$

Possible rational roots:  $\pm 1, \pm 11$ Roots:  $\{11, 1, -1\}$ 

9)  $x^3 - 3x^2 - x + 3 = 0$

Possible rational roots:  $\pm 1, \pm 3$ Roots:  $\{3, -1, 1\}$ 

10)  $x^3 + 3x^2 + 7x + 85 = 0$

Possible rational roots:  $\pm 1, \pm 5, \pm 17, \pm 85$ Roots:  $\{-5, 1 + 4i, 1 - 4i\}$

$$11) x^3 + 10x^2 + 36x + 40 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 4, \pm 5, \pm 8, \pm 10, \pm 20, \pm 40$   
Roots:  $\{-2, -4 + 2i, -4 - 2i\}$

$$12) x^3 - 9x^2 + 15x - 7 = 0$$

Possible rational roots:  $\pm 1, \pm 7$

Roots:  $\{7, 1 \text{ mult. } 2\}$

$$13) x^3 - 7x^2 + 11x - 5 = 0$$

Possible rational roots:  $\pm 1, \pm 5$

Roots:  $\{1 \text{ mult. } 2, 5\}$

$$14) x^3 + 5x^2 - 4x - 20 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 4, \pm 5, \pm 10, \pm 20$   
Roots:  $\{-5, 2, -2\}$

$$15) x^3 + 4x^2 + 6x - 36 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 9, \pm 12, \pm 18, \pm 36$   
Roots:  $\{2, -3 + 3i, -3 - 3i\}$

$$16) x^3 + 13x^2 + 23x + 11 = 0$$

Possible rational roots:  $\pm 1, \pm 11$

Roots:  $\{-11, -1 \text{ mult. } 2\}$

$$17) x^3 - x^2 - 4x + 4 = 0$$

Possible rational roots:  $\pm 1, \pm 2, \pm 4$

Roots:  $\{1, 2, -2\}$

$$18) x^3 - 7x^2 + 20x - 24 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$   
Roots:  $\{3, 2 + 2i, 2 - 2i\}$

$$19) x^3 - 13x^2 - x + 13 = 0$$

Possible rational roots:  $\pm 1, \pm 13$

Roots:  $\{13, -1, 1\}$

$$20) x^3 - 10x^2 + 41x - 50 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 5, \pm 10, \pm 25, \pm 50$   
Roots:  $\{2, 4 + 3i, 4 - 3i\}$

$$21) x^3 + x^2 - 5x - 5 = 0$$

Possible rational roots:  $\pm 1, \pm 5$

Roots:  $\{-1, \sqrt{5}, -\sqrt{5}\}$

$$22) x^3 + 2x^2 + 2x + 4 = 0$$

Possible rational roots:  $\pm 1, \pm 2, \pm 4$

Roots:  $\{-2, i\sqrt{2}, -i\sqrt{2}\}$

$$23) x^3 + 10x^2 + 48x + 64 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 4, \pm 8, \pm 16, \pm 32, \pm 64$

Roots:  $\{-2, -4 + 4i, -4 - 4i\}$

$$24) x^3 - 4x^2 + 5x - 2 = 0$$

Possible rational roots:  $\pm 1, \pm 2$

Roots:  $\{1 \text{ mult. } 2, 2\}$

$$25) x^3 - 13x^2 + 57x - 85 = 0$$

Possible rational roots:  $\pm 1, \pm 5, \pm 17, \pm 85$

Roots:  $\{5, 4 + i, 4 - i\}$

$$26) x^3 - 11x^2 + 55x - 125 = 0$$

Possible rational roots:  $\pm 1, \pm 5, \pm 25, \pm 125$

Roots:  $\{5, 3 + 4i, 3 - 4i\}$

$$27) x^3 + 9x^2 + 15x + 7 = 0$$

Possible rational roots:  $\pm 1, \pm 7$

Roots:  $\{-7, -1 \text{ mult. } 2\}$

$$28) x^3 - 2x^2 - x + 2 = 0$$

Possible rational roots:  $\pm 1, \pm 2$

Roots:  $\{2, 1, -1\}$

$$29) x^3 - 10x^2 + 48x - 64 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 4, \pm 8, \pm 16, \pm 32, \pm 64$

Roots:  $\{2, 4 + 4i, 4 - 4i\}$

$$30) x^3 - 3x^2 + x - 3 = 0$$

Possible rational roots:  $\pm 1, \pm 3$

Roots:  $\{3, i, -i\}$



$$31) x^3 - 5x^2 - 13x - 7 = 0$$

Possible rational roots:  $\pm 1, \pm 7$

Roots:  $\{7, -1 \text{ mult. } 2\}$

$$32) x^3 + x^2 + 4x + 30 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 3, \pm 5, \pm 6, \pm 10, \pm 15, \pm 30$

Roots:  $\{-3, 1 + 3i, 1 - 3i\}$

$$33) x^3 - x^2 + x - 1 = 0$$

Possible rational roots:  $\pm 1$

Roots:  $\{1, i, -i\}$

$$34) x^3 - 3x^2 + 2x - 6 = 0$$

Possible rational roots:  $\pm 1, \pm 2, \pm 3, \pm 6$

Roots:  $\{3, i\sqrt{2}, -i\sqrt{2}\}$

$$35) x^3 - 4x^2 - 36x - 48 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 16, \pm 24, \pm 48$

Roots:  $\{-2, 3 + \sqrt{33}, 3 - \sqrt{33}\}$

$$36) x^3 - 15x^2 + 27x - 13 = 0$$

Possible rational roots:  $\pm 1, \pm 13$

Roots:  $\{13, 1 \text{ mult. } 2\}$

$$37) x^3 - 2x^2 - 2x + 4 = 0$$

Possible rational roots:  $\pm 1, \pm 2, \pm 4$

Roots:  $\{2, \sqrt{2}, -\sqrt{2}\}$

$$38) x^3 + x^2 - 12x + 40 = 0$$

Possible rational roots:

$\pm 1, \pm 2, \pm 4, \pm 5, \pm 8, \pm 10, \pm 20, \pm 40$

Roots:  $\{-5, 2 + 2i, 2 - 2i\}$

$$39) x^3 - 2x^2 + 5x + 26 = 0$$

Possible rational roots:  $\pm 1, \pm 2, \pm 13, \pm 26$

Roots:  $\{-2, 2 + 3i, 2 - 3i\}$

$$40) x^3 - 2x^2 + 4x - 8 = 0$$

Possible rational roots:  $\pm 1, \pm 2, \pm 4, \pm 8$

Roots:  $\{2, 2i, -2i\}$

41)  $x^3 + 11x^2 - x - 11 = 0$

Possible rational roots:  $\pm 1, \pm 11$ Roots:  $\{-11, -1, 1\}$ 

42)  $x^3 - 3x^2 - 39x + 145 = 0$

Possible rational roots:  $\pm 1, \pm 5, \pm 29, \pm 145$ Roots:  $\{5, -1 + \sqrt{30}, -1 - \sqrt{30}\}$ 

43)  $x^3 - 9x^2 - 21x - 11 = 0$

Possible rational roots:  $\pm 1, \pm 11$ Roots:  $\{-1 \text{ mult. } 2, 11\}$ 

44)  $x^3 - x^2 - 5x + 5 = 0$

Possible rational roots:  $\pm 1, \pm 5$ Roots:  $\{1, \sqrt{5}, -\sqrt{5}\}$ 

45)  $x^3 + 2x^2 - 2x - 4 = 0$

Possible rational roots:  $\pm 1, \pm 2, \pm 4$ Roots:  $\{-2, \sqrt{2}, -\sqrt{2}\}$ 

46)  $x^3 + 5x^2 - x - 5 = 0$

Possible rational roots:  $\pm 1, \pm 5$ Roots:  $\{1, -5, -1\}$ 

47)  $x^3 - 2x^2 + 12x + 40 = 0$

Possible rational roots:

 $\pm 1, \pm 2, \pm 4, \pm 5, \pm 8, \pm 10, \pm 20, \pm 40$ Roots:  $\{-2, 2 + 4i, 2 - 4i\}$ 

48)  $x^3 + 15x^2 + 27x + 13 = 0$

Possible rational roots:  $\pm 1, \pm 13$ Roots:  $\{-13, -1 \text{ mult. } 2\}$ 

49)  $x^3 + 9x^2 - 21x + 11 = 0$

Possible rational roots:  $\pm 1, \pm 11$ Roots:  $\{-11, 1 \text{ mult. } 2\}$ 

50)  $x^3 - 4x^2 + x + 26 = 0$

Possible rational roots:  $\pm 1, \pm 2, \pm 13, \pm 26$ Roots:  $\{-2, 3 + 2i, 3 - 2i\}$