

Today we learned about finding possible rational roots. Where the P's are the constant term and the Q's are the leading coefficient of the polynomial. Below are the notes we took in class and the homework assignment.

Possible Rational Roots:

P: Factors of the constant term 6: 1, 2, 3, 6

Q: Factors of the leading coefficient 3: 1, 3

$\pm \frac{p}{q}$: $\pm 1, \frac{1}{3}, 2, \frac{2}{3}, 3, 6$ $\frac{3}{3}=1$ so left out $\frac{6}{3}=2$ so left out

If your calculator does not give you a head start, you must find the possible rational roots.

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

Ca. -3
P: $\pm 1, 3$

Lc. 4
Q: $\pm 1, 2, 4$

$\pm \frac{p}{q}$: $\pm 1, \frac{1}{2}, \frac{1}{4}, 3, \frac{3}{2}, \frac{3}{4}$

Type the possible rational roots into the table of your calculator. If the possible rational root gives you a 0 for the y value, then that number is one of your roots.

Finding Possible Rational Roots

State the possible rational roots for each function.

1) $f(x) = 3x^4 - x^2 - 10$

P: 1, 2, 5, 10

Q: 1, 3

$$\pm \frac{P}{Q} : \pm \left(1, \frac{1}{3}, 2, \frac{2}{3}, 5, \frac{5}{3}, 10, \frac{10}{3} \right)$$

3) $f(x) = 2x^3 - x^2 + 10x - 5$

P: 1, 5

Q: 1, 2

$$\frac{P}{Q} : \pm \left(1, \frac{1}{2}, 5, \frac{5}{2} \right)$$

5) $f(x) = 5x^4 - 48x^2 + 27$

P: 1, 3, 9, 27

Q: 1, 5

$$\frac{P}{Q} : \pm \left(1, \frac{1}{5}, 3, \frac{3}{5}, 9, \frac{9}{5}, 27, \frac{27}{5} \right)$$

7) $f(x) = 2x^4 - 15x^2 + 28$

P: 1, 2, 4, 7, 14, 28

Q: 1, 2

$$\frac{P}{Q} : \pm \left(1, \frac{1}{2}, 2, 4, 7, \frac{7}{2}, 14, 28 \right)$$

9) $f(x) = 3x^3 - x^2 - 3x + 1$

P: 1

Q: 1, 3

$$\frac{P}{Q} : \pm \left(1, \frac{1}{3} \right)$$

2) $f(x) = 5x^3 + 9x^2 + 3x - 1$

P: 1

Q: 1, 5

$$\pm \frac{P}{Q} : \pm \left(1, \frac{1}{5} \right)$$

4) $f(x) = 15x^5 - 5x^4 + 21x^3 - 7x^2 + 6x - 2$

P: 1, 2

Q: 1, 3, 5, 15

$$\frac{P}{Q} : \pm \left(1, \frac{1}{3}, \frac{1}{5}, \frac{1}{15}, 2, \frac{2}{3}, \frac{2}{5}, \frac{2}{15} \right)$$

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

P: 1, 2, 4

Q: 1, 3

$$\frac{P}{Q} : \pm \left(1, \frac{1}{3}, 2, \frac{2}{3}, 4, \frac{4}{3} \right)$$

8) $f(x) = 5x^3 + 29x^2 + 19x - 5$

P: 1, 5

Q: 1, 5

$$\frac{P}{Q} : \pm \left(1, \frac{1}{5}, 5 \right)$$

10) $f(x) = 5x^4 - 13x^2 - 6$

P: 1, 2, 3, 6

Q: 1, 5

$$\frac{P}{Q} : \pm \left(1, \frac{1}{5}, 2, \frac{2}{5}, 3, \frac{3}{5}, 6, \frac{6}{5} \right)$$

Find all roots. One root has been given.

11) $f(x) = x^4 - 26x^2 + 25; -5$

$$\begin{array}{r} -5 \overline{) 1 \ 0 \ -26 \ 0 \ 25} \\ \underline{-5 \ 25 \ 5 \ -25} \end{array}$$

$$1 \ -5 \ -1 \ 5 \ 0$$

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

x^2	x^3	$-5x^2$
-1	$-x$	5

 $(x^2-1)(x-5) = 0$
 $\pm 1 \ 5$

Roots:
 $\pm 1, \pm 5$

13) $f(x) = x^3 + 8x^2 + 20x + 16; -2$

$$\begin{array}{r} -2 \overline{) 1 \ 8 \ 20 \ 16} \\ \underline{-2 \ -12 \ -16} \end{array}$$

$$1 \ 6 \ 8 \ 0$$

$$x^2 + 6x + 8 = 0$$

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

$$x = -4 \ x = -2$$

Roots:
 $-4, -2, -2$

15) $f(x) = x^4 + 7x^3 + 9x^2 - 7x - 10; -5$

$$\begin{array}{r} -5 \overline{) 1 \ 7 \ 9 \ -7 \ -10} \\ \underline{-5 \ -10 \ 5 \ 10} \end{array}$$

$$1 \ 2 \ -1 \ -2 \ 0$$

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

x^2	x^3	$2x^2$
-1	$-x$	-2

 $(x^2-1)(x+2) = 0$
 $x = \pm 1 \ x = -2$

Roots:
 $-5, \pm 1, -2$

17) $f(x) = x^4 + x^3 - 10x^2 - 4x + 24; -3$

$$\begin{array}{r} -3 \overline{) 1 \ 1 \ -10 \ -4 \ 24} \\ \underline{-3 \ 6 \ 12 \ -24} \end{array}$$

$$1 \ -2 \ -4 \ 8 \ 0$$

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

x^2	x^3	$-2x^2$
-4	$-4x$	8

 $(x^2-4)(x-2) = 0$
 $x = \pm 2 \ x = 2$

Roots:
 $-3, \pm 2, 2$

12) $f(x) = x^3 + 3x^2 - 18x - 40; -5$

$$\begin{array}{r} -5 \overline{) 1 \ 3 \ -18 \ -40} \\ \underline{-5 \ 10 \ 40} \end{array}$$

$$1 \ -2 \ -8 \ 0$$

$$x^2 - 2x - 8 = 0$$

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

$$x = 4 \ x = -2$$

Roots: $-5, -2, 4$

14) $f(x) = x^3 + 6x^2 - 7x - 60; 3$

$$\begin{array}{r} 3 \overline{) 1 \ 6 \ -7 \ -60} \\ \underline{3 \ 27 \ 60} \end{array}$$

$$1 \ 9 \ 20 \ 0$$

$$x^2 + 9x + 20 = 0$$

$$(x+4)(x+5) = 0$$

$$x = -4 \ x = -5$$

Roots:
 $-5, -4, 3$

16) $f(x) = 6x^3 - 11x^2 - 26x + 15; 3$

$$\begin{array}{r} 3 \overline{) 6 \ -11 \ -26 \ 15} \\ \underline{18 \ 21 \ -15} \end{array}$$

$$6 \ 7 \ -5 \ 0$$

$$6x^2 + 7x - 5 = 0$$

$$(3x+5)(2x-1) = 0$$

$$x = -5/3 \ x = 1/2$$

Roots:
 $-5/3, 1/2, 3$

18) $f(x) = 2x^3 - 3x^2 - 62x + 168; -6$

$$\begin{array}{r} -6 \overline{) 2 \ -3 \ -62 \ 168} \\ \underline{-12 \ 90 \ -168} \end{array}$$

$$2 \ -15 \ 18 \ 0$$

$$2x^2 - 15x + 18 = 0$$

$$(2x-3)(x-6) = 0$$

$$x = 3/2 \ x = 6$$

Roots:
 $-6, 3/2, 6$