

Polynomial Division & Finding Roots

August 18, 2014

Algebra 2 Assignment Find all roots. 1) $(3x^2 - 5)(x + 3)(x - 3) = 0$ $\begin{array}{r} 3x^2 - 5 = 0 \\ \hline x+3=0 & x-3=0 \\ \hline -3-3 & \\ x=-3 & \\ \hline x=\pm\sqrt{5/3} \end{array}$ Divide. 5) $(x^3 - x^2 - 20x - 60) \div (x - 6)$ 6) $(n^3 + 3n^2 - 45n - 49) \div (n - 6)$ 7) $(3x^4 - 30x^3 + 52x^2 - 42x + 80) \div (x - 8)$ 8) $(v^4 - 9v^3 + 11v^2 + 50v - 38) \div (v - 6)$	Name _____ ID: 1 Date _____ Period _____ 2) $(3x - 2)(3x^2 + 2)(x^2 - 6) = 0$ 4) $(x + 3)(x^2 + 7)(3x^2 + 4) = 0$
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Find all roots. 9) $x^4 - 16x^2 + 63 = 0$ Hint: $x^4 + \boxed{0}x^3 - 16x^2 + \boxed{0}x + 63 = 0$ $\downarrow \quad 1 \quad 0 \quad -16 \quad 0 \quad 63$ $\text{P}_2 \quad \text{S}$	8) $(v^4 - 9v^3 + 11v^2 + 50v - 38) \div (v - 6)$ 10) $x^4 - x^2 - 42 = 0$
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6) $(n^3 + 3n^2 - 45n - 49) \div (n - 6)$ $\begin{array}{r} n-6 \quad \quad 1 \quad 3 \quad -45 \quad -49 \\ \hline 6 \quad \quad 6 \quad 54 \quad 54 \\ \hline 1 \quad 9 \quad x \quad 9 \quad \boxed{15} \quad \text{constant} \\ \text{remainder} \end{array}$ $(n-6)\left(n^2 + 9n + 9 + \frac{5}{n-6}\right)$	$\left\{ \begin{array}{l} 6 \sqrt{41} \\ -36 \\ \hline 5 \end{array} \right.$
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Divide. 5) $(x^3 - x^2 - 20x - 60) \div (x - 6)$ $\begin{array}{r} x-6 \quad \quad x^3 - x^2 - 20x - 60 \\ \hline x-6=0 \end{array}$ $\begin{array}{r} \boxed{6} \quad \quad 1 \quad -1 \quad -20 \quad -60 \\ \hline 6 \quad \quad 6 \quad 30 \quad 60 \\ \hline 1 \quad x^2 \quad 5x \quad 10 \quad \boxed{0} \quad \text{constant} \end{array}$ $(x-6)(x^2 + 5x + 10)$ <ul style="list-style-type: none"> • Factor • $b^2 - 4ac = 5^2 - 4(1)(10) = 25 - 40 = -15$ $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-5 \pm \sqrt{25 - 4(1)(10)}}{2(1)} = \frac{-5 \pm \sqrt{25 - 40}}{2} = \frac{-5 \pm \sqrt{-15}}{2}$ $x = \frac{-5 + \sqrt{-15}}{2}, \frac{-5 - \sqrt{-15}}{2}$ $x = \frac{-5 + i\sqrt{15}}{2}, \frac{-5 - i\sqrt{15}}{2}$ 	6) $(n^3 + 3n^2 - 45n - 49) \div (n - 6)$ $\begin{array}{r} n-6 \quad \quad n^3 + 3n^2 - 45n - 49 \\ \hline n-6=0 \end{array}$ $(n-6)(n^2 + 9n + 9)$ <ul style="list-style-type: none"> • Find all factors. $n = 1, 5, 10$ $n^2 + 9n + 9 = 0$ $n = \frac{-9 \pm \sqrt{81 - 4(1)(9)}}{2(1)} = \frac{-9 \pm \sqrt{81 - 36}}{2} = \frac{-9 \pm \sqrt{45}}{2} = \frac{-9 \pm 3\sqrt{5}}{2}$ $n = \frac{-9 + 3\sqrt{5}}{2}, \frac{-9 - 3\sqrt{5}}{2}$
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$$4) (x+3)(x^2+7)(3x^2+4)=0$$

$$x+3=0 \quad x^2+7=0 \quad 3x^2+4=0$$

$$x=-3 \quad \sqrt{x^2}=\sqrt{-7} \quad 3x^2=-4$$

$$x=\pm\sqrt{-7} \quad \text{No real solution} \quad x=\pm\sqrt{-4/3}$$

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

$$3x^2-4=0 \quad x+3=0 \quad x-3=0$$

$$3x^2=4 \quad \frac{-3-3}{x=-3} \quad x=3$$

$$x^2=\frac{4}{3} \quad x=\pm\sqrt{\frac{4}{3}}$$

Simplify

$$x=\pm\frac{\sqrt{4}}{\sqrt{3}}=\left[\pm\frac{2}{\sqrt{3}}\right] \text{ (f)} = \left[\pm\frac{2\sqrt{3}}{3}\right]$$

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

FACTORS

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

$$x=\pm\sqrt{\frac{5}{3}} \quad x=-3 \quad x=3$$

$$x=\pm\sqrt{\frac{5}{3}}$$

$$\text{Roots } \left\{ \pm\sqrt{\frac{5}{3}}, -3, 3 \right\}$$

$$x=\pm\sqrt{\frac{5}{3}}$$

$$x=3$$

$$x=-3$$

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

$$3x-2=0 \quad 3x^2+2=0 \quad x^2-6=0$$

$$x=\frac{2}{3} \quad \text{No real solution} \quad x=\pm\sqrt{6}$$

$$x=\pm\sqrt{\frac{2}{3}}$$

know

$$\text{question: } x=\pm\sqrt{\frac{2}{3}}$$

$$x=\pm\sqrt{\frac{2}{3}}$$

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Find all roots.

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

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

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

$$4) (x+3)(x^2+7)(3x^2+4)=0$$

Divide.

$$5) (x^3-x^2-20x-60) \div (x-6)$$

$$6) (n^3+3n^2-45n-49) \div (n-6)$$

$$7) (3x^4-30x^3+52x^2-42x+80) \div (x-8)$$

$$8) (v^4-9v^3+11v^2+50v-38) \div (v-6)$$

Find all roots.

$$9) x^4-16x^2+63=0$$

$$x^4+0x^3-16x^2+0x+63=0$$

$$1 \quad 0 \quad -16 \quad 0 \quad 63$$

$$10) x^4-x^2-42=0$$

$\frac{1}{4}$

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Solve for x .

Find all roots.

FACTORS

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

$x = \pm\sqrt{\frac{5}{3}}$

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

$x = \frac{2}{3}$, $3x^2 + 2 = 0$, $x^2 - 6 = 0$

$x = \pm\sqrt{-\frac{2}{3}}$

$x = \pm i\sqrt{\frac{2}{3}}$

$x^2 - 6 = 0$

$x = \pm\sqrt{6}$

How many answers should you get?

What is the degree of the polynomial?

degree = # of answers

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

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

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

$x = \pm\sqrt{\frac{4}{3}}$

$x = \pm\sqrt{\frac{4}{3}}$

$x = \pm\sqrt{\frac{2}{3}}$

$x = \pm\sqrt{2}$

$x = \pm\sqrt{2}$

$x = \pm\sqrt{2}$

4) $(x + 3)(x^2 + 7)(3x^2 + 4) = 0$

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

$x = -3$, $x = 3$, $x = \pm\sqrt{-7}$

$x = \pm\sqrt{-7}$

$x = \pm i\sqrt{7}$

$x = \pm i\sqrt{7}$

$x = \pm\sqrt{4}$

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Where were you in 1992? $q^{th}, 10^{th}$

graphing calculator born in 1992

531 BC Pythagoras Geometry

Divide.

$(2x^2 - 5x + 10) \div (x - 6)$

$x - 6 = 0$

$x = 6$

$\begin{array}{r} 6 \\ \underline{)1 \quad -1 \quad -20 \quad -60} \\ \underline{6 \quad 30 \quad 60} \\ 1 \quad 5 \quad 10 \quad 0 \end{array}$

remainder

$(x - 6)(x^2 + 5x + 10)$

FACTOR

$n^3 + 3n^2 - 45n - 49 \div (n - 6)$

$\begin{array}{r} 6 \\ \underline{)1 \quad 3 \quad -45 \quad -49} \\ \underline{6 \quad 9 \quad 9 \quad 54} \\ 1 \quad 9 \quad 9 \quad 5 \end{array}$

constant remainder

$(n^2 + 9n + 9 + \frac{5}{(n-6)})$

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$$5) (x^3 - x^2 - 20x - 60) \div (x - 6)$$

$$\begin{array}{r} x \\ \overline{x-6) } x^3 - x^2 - 20x - 60 \\ -(-x^3 + 6x^2) \\ \hline 5x^2 - 20x \\ -(-5x^2 + 30x) \\ \hline 10x - 60 \\ -(-10x + 60) \\ \hline 0 \end{array}$$

$$\begin{array}{r} 8 \\ \overline{5) 43} \\ -40 \\ \hline 3 \\ (5)(8) = 40 \end{array}$$

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Algebra 2
Assignment
Find all roots.

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

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

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

$$4) (x + 3)(x^2 + 7)(3x^2 + 4) = 0$$

Divide.
5) $(x^3 - x^2 - 20x - 60) \div (x - 6)$ FACTOR

$$7) (3x^4 - 30x^3 + 52x^2 - 42x + 80) \div (x - 8)$$

$$8) (v^4 - 9v^3 + 11v^2 + 50v - 38) \div (v - 6)$$

Find all roots.

$$9) x^4 - 16x^2 + 63 = 0$$

$$10) x^4 - x^2 - 42 = 0$$

Find all roots.

$$\sqrt[4]{\frac{63}{1}} = \pm \frac{\pm 3, \pm 21}{\pm 1}$$

$$9) x^4 - 16x^2 + 63 = 0$$

$$x^4 + 0x^3 - 16x^2 + 0x + 63 = 0$$

$$\begin{array}{r} 3 \\ \overline{(x-3))} 1 \ 0 \ -16 \ 0 \ 63 \\ \downarrow \quad 3 \quad 9 \quad -21 \quad -63 \\ \hline 1x^3 \ 3x^2 - 7x \ -21 \ 0 \end{array}$$

$$\begin{array}{r} x^3 + 3x^2 - 7x - 21 \\ \hline (x+3) \ 1 \ 3 \ -7 \ -21 \\ \downarrow \quad -3 \quad 0 \ 21 \\ \hline 1x^2 \ 0x \ -7 \ 0 \end{array}$$

$$(x^2 - 7)$$

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

$$x = 3 \quad x = -3 \quad x^2 = 7$$

$$x = \pm \sqrt{7}$$

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6) $(n^3 + 3n^2 - 45n - 49) \div (n - 6)$

$$\begin{array}{r} (n-6) \\ \overline{)1 \quad 3 \quad -45 \quad -49} \\ \downarrow \quad 6 \quad 54 \quad 54 \\ 1 \quad 9 \quad 9 \quad \boxed{5} \\ \text{remainder} \end{array}$$

$$(n-6)(n^2 + 9n + 9 + \frac{5}{(n-6)})$$

$$(n^2 + 9n + 9 + \frac{5}{(n-6)})(n-6)$$

$$(n-6)n^2 + (n-6)9n + 9(n-6) + (n-6)\left(\frac{5}{(n-6)}\right)$$

$$\begin{array}{r} 8^{3/5} \\ \overline{)5 \quad 43} \\ \underline{-40} \\ \hline 13 \end{array}$$

$$5(8^{3/5}) = 43$$

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Divide. $\frac{x^3 + 6}{x-6} = 0$ (2x-5) $x = \frac{5}{2}$
FACTORS

5) $(x^3 - x^2 - 20x - 60) \div (x - 6)$

6) $1 \quad -1 \quad -20 \quad -60$

$x-6 \overline{)x^3 - x^2 - 20x - 60}$

$\downarrow \quad 6 \quad 30 \quad 60$

$1 \quad x^2 + 5x + 10 \quad \boxed{0}$
constant
(x-6)(x² + 5x + 10)

Solve for x.

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

FACTORS

$3x^2 - 5 = 0$

$+5 +5$

$3x^2 = 5$

$\sqrt{3x^2} = \sqrt{5}$

$x = \pm \sqrt{\frac{5}{3}}$

$x+3=0$

$-3 -3$

$x = -3$

$+3 +3$

$x = 3$

$x-3=0$

$+3 +3$

$x = 3$

$+3 +3$

$x = 3$

$3x^2 + 2 = 0$

$-2 -2$

$x = -\frac{2}{3}$

$\sqrt{3x^2} = -2$

$x = \pm \sqrt{\frac{2}{3}}$

$y=0$

$x^2 - 6 = 0$

$x^2 = 6$

$x = \pm \sqrt{6}$

$x = \pm \sqrt{1}$

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$$\frac{-}{\sqrt{2/3}} \text{ or } \sqrt{2/3}$$

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Find all roots.

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

$$\left\{ \frac{\sqrt{15}}{3}, -\frac{\sqrt{15}}{3}, -3, 3 \right\}$$

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

$$\left\{ \frac{2}{3}, \frac{\sqrt{6}}{3}, -\frac{\sqrt{6}}{3}, \sqrt{6}, -\sqrt{6} \right\}$$

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

$$\left\{ \frac{2\sqrt{3}}{3}, -\frac{2\sqrt{3}}{3}, -3, 3 \right\}$$

4) $(x + 3)(x^2 + 7)(3x^2 + 4) = 0$

$$\left\{ -3, i\sqrt{7}, -i\sqrt{7}, \frac{2i\sqrt{3}}{3}, -\frac{2i\sqrt{3}}{3} \right\}$$

Divide.

5) $(x^3 - x^2 - 20x - 60) \div (x - 6)$

$$x^2 + 5x + 10$$

6) $(n^3 + 3n^2 - 45n - 49) \div (n - 6)$

$$n^2 + 9n + 9 + \frac{5}{n-6}$$

7) $(3x^4 - 30x^3 + 52x^2 - 42x + 80) \div (x - 8)$

$$3x^3 - 6x^2 + 4x - 10$$

8) $(v^4 - 9v^3 + 11v^2 + 50v - 38) \div (v - 6)$

$$v^3 - 3v^2 - 7v + 8 + \frac{10}{v-6}$$

Find all roots.

9) $x^4 - 16x^3 + 63 = 0$

$$\left\{ \sqrt{7}, -\sqrt{7}, -3, 3 \right\}$$

10) $x^4 - x^2 - 42 = 0$

$$\left\{ \sqrt{6}, -i\sqrt{6}, \sqrt{7}, -\sqrt{7} \right\}$$

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