

★ Skip 21 & 22

Alg2 Review 5.4-5.6

Name: Key

**Divide Using Long Division**

1.  $(3x^3 - x^2 - 7x + 6) \div (x + 2)$

$$\begin{array}{r}
 3x^2 - 7x + 7 \quad R: -8 \\
 x+2 \overline{) 3x^3 - x^2 - 7x + 6} \\
 \underline{-3x^3 + 6x^2} \phantom{+ 0} \\
 -7x^2 - 7x \phantom{+ 6} \\
 \underline{-7x^2 + 14x} \phantom{+ 6} \\
 7x + 6 \\
 \underline{-7x + 14} \\
 -8
 \end{array}$$

2.  $(3x^3 - 70x + 2) \div (x - 5)$

$$\begin{array}{r}
 3x^2 + 15x + 5 \quad R: 27 \\
 x-5 \overline{) 3x^3 + 0x^2 - 70x + 2} \\
 \underline{-3x^3 + 15x^2} \phantom{+ 0} \\
 15x^2 - 70x \phantom{+ 2} \\
 \underline{-15x^2 + 75x} \phantom{+ 2} \\
 5x + 2 \\
 \underline{-5x + 25} \\
 27
 \end{array}$$

**Divide Using Synthetic division**

3.  $(x^3 - 6x^2 + 3x - 2) \div (x - 2)$

$$\begin{array}{r}
 2 \overline{) 1 \quad -6 \quad 3 \quad -2} \\
 \underline{\phantom{2} 2 \quad -8 \quad -10} \\
 1 \quad -4 \quad -5 \quad -12 \\
 \hline
 x^2 - 4x - 5 \quad R: -12
 \end{array}$$

4.  $(x^3 + 6x^2 - 2) \div (x - 3)$

$$\begin{array}{r}
 3 \overline{) 1 \quad 6 \quad 0 \quad -2} \\
 \underline{\phantom{3} 3 \quad 27 \quad 81} \\
 1 \quad 9 \quad 27 \quad 79 \\
 \hline
 x^2 + 9x + 27 \quad R: 79
 \end{array}$$

Determine if the following binomial is a factor of  $x^3 + 3x^2 - 10x - 24$

5.  $x + 4$

$$\begin{array}{r}
 -4 \overline{) 1 \quad 3 \quad -10 \quad -24} \\
 \underline{-4 \quad 4 \quad 24} \\
 1 \quad -1 \quad -6 \quad 0
 \end{array}$$

yes

6.  $x - 3$

$$\begin{array}{r}
 3 \overline{) 1 \quad 3 \quad -10 \quad -24} \\
 \underline{\phantom{3} 3 \quad 18 \quad 24} \\
 1 \quad 6 \quad 8 \quad 0
 \end{array}$$

yes

7.  $x + 6$

$$\begin{array}{r}
 -6 \overline{) 1 \quad 3 \quad -10 \quad -24} \\
 \underline{-6 \quad 18 \quad -48} \\
 1 \quad -3 \quad 8 \quad -72
 \end{array}$$

No

Use synthetic division and the given factor to factor completely

8.  $y = 2x^3 + 9x^2 + 13x + 6; (x+1)$

$$\begin{array}{r|rrrr} -1 & 2 & 9 & 13 & 6 \\ & & -2 & -7 & -6 \\ \hline & 2 & 7 & 6 & 0 \end{array}$$

$$2x^2 + 7x + 6$$

$$y = (2x+3)(x+2)(x+1)$$

9.  $y = x^3 + 4x^2 - 7x - 10; (x-2)$

$$\begin{array}{r|rrrr} 2 & 1 & 4 & -7 & -10 \\ & & 2 & 12 & 10 \\ \hline & 1 & 6 & 5 & 0 \end{array}$$

$$x^2 + 6x + 5$$

$$y = (x+1)(x+5)(x-2)$$

10. The expression  $V(x) = x^3 + 3x^2 - 13x - 15$  represents the volume of a rectangular safe in cubic feet. The length of the safe is  $x-3$ . Write the length of the other two sides in a linear expression.

$$\begin{array}{r|rrrr} 3 & 1 & 3 & -13 & -15 \\ & & 3 & 18 & 15 \\ \hline & 1 & 6 & 5 & 0 \end{array}$$

$$x^2 + 6x + 5$$

$$(x+5)(x+1)$$

$$(x+5) \text{ ft}$$

$$(x+1) \text{ ft}$$

List all the possible roots.

11.  $2x^3 + 5x^2 + 4x + 1$

$$\frac{\pm 1}{\pm 1, \pm 2}$$

$$\text{possible: } \pm 1, \pm \frac{1}{2}$$

12.  $6x^3 + 5x^2 - 3x + 12$

$$\frac{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12}{\pm 1, \pm 2, \pm 3, \pm 6}$$

$$\text{possible: } \pm 1, \pm \frac{1}{2}, \pm \frac{1}{3}, \pm \frac{1}{6}, \pm 2, \pm \frac{2}{3}, \pm 3, \pm \frac{3}{2}, \pm 4, \pm \frac{4}{3}, \pm 6, \pm 12$$

Find all the rational Roots.

13.  $P(x) = x^3 - 5x^2 + 2x + 8$

$$\begin{array}{r|rrrr} -1 & 1 & -5 & 2 & 8 \\ & & -1 & 6 & -8 \\ \hline & 1 & -6 & 8 & 0 \end{array}$$

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

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

$$\begin{array}{c|c} 4 & 2 \\ \hline -1 & 4 & 2 \end{array}$$

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

$$\begin{array}{r|rrrr} -2 & 1 & -2 & -5 & 6 \\ & & -2 & 8 & -6 \\ \hline & 1 & -4 & 3 & 0 \end{array}$$

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

$$(x-3)(x-1) = 0$$

$$\begin{array}{c|c} 3 & 1 \\ \hline -2 & 3 & 1 \end{array}$$

15.  $P(x) = 2x^3 + 13x^2 + 17x - 12$

$$\begin{array}{r|rrrr} -3 & 2 & 13 & 17 & -12 \\ & & -6 & -21 & 12 \\ \hline & 2 & 7 & -4 & 0 \end{array}$$

$$2x^2 + 7x - 4 = 0$$

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

$$\begin{array}{c|c} 1/2 & -4 \\ \hline -3 & 1/2 & -4 \end{array}$$

16.  $P(x) = 4x^3 - 12x^2 - x + 3$

$$\begin{array}{r|rrrr} 3 & 4 & -12 & -1 & 3 \\ & & 12 & 0 & -3 \\ \hline & 4 & 0 & -1 & 0 \end{array}$$

$$4x^2 - 1 = 0$$

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

$$\begin{array}{c|c} -1/2 & 1/2 \\ \hline -1/2 & 1/2 & 3 \end{array}$$

Find all the roots.

17.  $P(x) = x^3 + x^2 - 7x + 2$

$$\begin{array}{r|rrrr} 2 & 1 & 1 & -7 & 2 \\ & & 2 & 6 & -2 \\ \hline & 1 & 3 & -1 & 0 \end{array}$$

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

$$a=1 \quad b=3 \quad c=-1$$

$$\frac{-3 \pm \sqrt{9 - 4(1)(-1)}}{2(1)} = \frac{-3 \pm \sqrt{13}}{2}$$

$$\begin{array}{c} 2, \frac{-3 + \sqrt{13}}{2}, \\ \frac{-3 - \sqrt{13}}{2} \end{array}$$

18.  $P(x) = x^3 - 6x^2 + 13x - 10$

$$\begin{array}{r|rrrr} 2 & 1 & -6 & 13 & -10 \\ & & 2 & -8 & 10 \\ \hline & 1 & -4 & 5 & 0 \end{array}$$

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

$$a=1 \quad b=-4 \quad c=5$$

$$x = \frac{4 \pm \sqrt{16 - 4(1)(5)}}{2(1)}$$

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

$$\begin{array}{c} 2+i, \\ 2-i, \\ 2 \end{array}$$

19.  $P(x) = x^3 + 4x^2 + 9x + 36$

$$\begin{array}{r|rrrr} -4 & 1 & 4 & 9 & 36 \\ & & -4 & 0 & -36 \\ \hline & 1 & 0 & 9 & 0 \end{array}$$

$$x^2 + 9 = 0$$

$$\sqrt{x^2} = \sqrt{-9}$$

$$x = \pm 3i$$

$$\boxed{3i, -3i, -4}$$

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21.  $P(x) = x^4 - 8x^3 + 19x^2 - 32x + 60$

$$\begin{array}{r|rrrrr} 3 & 1 & -8 & 19 & -32 & 60 \\ & & 3 & -15 & 12 & -60 \\ \hline & 1 & -5 & 4 & -20 & 0 \end{array}$$

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

$$\begin{array}{r|rrrr} 5 & 1 & -5 & 4 & -20 \\ & & 5 & 0 & 20 \\ \hline & 1 & 0 & 4 & 0 \end{array}$$

$$x^2 + 4 = 0 \quad \sqrt{x^2} = \sqrt{-4} \quad x = \pm 2i$$

$$\boxed{2i, -2i, 3, 5}$$

Write a polynomial function given the roots.

23.  $-4$  and  $5i, -5i$

$$y = (x+4)(x-5i)(x+5i)$$

$$y = (x+4)(x^2 - 25i^2)$$

$$y = (x+4)(x^2 + 25)$$

$$y = x^3 + 4x^2 + 25x + 100$$

24.  $2i$  and  $\sqrt{2}, -2i, -\sqrt{2}$

$$y = (x-2i)(x+2i)(x-\sqrt{2})(x+\sqrt{2})$$

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

$$y = x^4 + 2x^2 - 8$$

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

$$\begin{array}{r|rrrr} 5 & 1 & -5 & 1 & -5 \\ & & 5 & 0 & 5 \\ \hline & 1 & 0 & 1 & 0 \end{array}$$

$$x^2 + 1 = 0$$

$$\sqrt{x^2} = \sqrt{-1}$$

$$x = \pm i$$

$$\boxed{i, -i, 5}$$

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22.  $P(x) = x^5 + 3x^4 - 8x^3 - 24x^2 - 9x - 27$

$$\begin{array}{r|rrrrrr} 3 & 1 & 3 & -8 & -24 & -9 & -27 \\ & & 3 & 18 & 30 & 18 & 27 \\ \hline & 1 & 6 & 10 & 6 & 9 & 0 \end{array}$$

$$x^4 + 6x^3 + 10x^2 + 6x + 9 = 0$$

$$\begin{array}{r|rrrrr} -3 & 1 & 6 & 10 & 6 & 9 \\ & & -3 & -9 & -3 & -9 \\ \hline & 1 & 3 & 1 & 3 & 0 \end{array}$$

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

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

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

$$x^2 + 1 = 0$$

$$\sqrt{x^2} = \sqrt{-1}$$

$$x = \pm i$$

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

$$\boxed{3, -3, i, -i}$$

25.  $-\frac{2}{5}$  and  $\sqrt{3}, -\sqrt{3}$

$$y = (5x+2)(x-\sqrt{3})(x+\sqrt{3})$$

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

$$y = 5x^3 + 2x^2 - 15x - 6$$