

Factoring and Solving Higher Order Polynomial Worksheet

Factor Completely:

- $64x^3 + xy^3 = x(64x^2 + y^3)$
- $w^3 - 8y^3 = (w - 2y)(w^2 + 2wy + 4y^2)$

Solve Completely (Remember, once you get to a 2nd power polynomial/Quadratic, you have factoring, square root property, and quadratic formula to utilize):

- $x^4 + x^2 - 90 = 0$ $(x^2 + 10)(x^2 - 9) = 0$ $x^2 = -10$ $x^2 = 9$ $x = \pm i\sqrt{10}, \pm 3$
- $64x^3 + 1 = 0$ $(4x + 1)(16x^2 - 4x + 1) = 0$ $x = -\frac{1}{4}$ $x = \frac{4 \pm \sqrt{16 - 4(16)(1)}}{32} = \frac{4 \pm i\sqrt{64}}{32} = \frac{4 \pm 8i}{32} = \frac{1 \pm 2i}{8}$
- $27x^3 - 1000 = 0$ $(3x - 10)(9x^2 + 30x + 100) = 0$ $x = \frac{10}{3}$ $x = \frac{-30 \pm \sqrt{900 - 4(9)(100)}}{18} = \frac{-30 \pm \sqrt{-2700}}{18} = \frac{-30 \pm 30i\sqrt{3}}{18} = \frac{-5 \pm 5i\sqrt{3}}{3}$
- $x^4 - 625 = 0$ $(x^2 - 25)(x^2 + 25) = 0$ $x^2 - 25 = 0$ $x^2 = 25$ $x = \pm 5$ $x^2 + 25 = 0$ $x^2 = -25$ $x = \pm 5i$
- $x^4 + 6x^2 + 5 = 0$ $(x^2 + 5)(x^2 + 1) = 0$ $x^2 = -5$ $x^2 = -1$ $x = \pm i\sqrt{5}, \pm i$
- Tricky 😊: $x^6 - 26x^3 - 27 = 0$
 $(x^3 - 27)(x^3 + 1) = 0$ $(x - 3)(x^2 + 3x + 9)(x + 1)(x^2 + x + 1) = 0$
 $x = 3, -1$ $x = \frac{-3 \pm \sqrt{9 - 4(1)(9)}}{2} = \frac{-3 \pm \sqrt{-27}}{2} = \frac{-3 \pm 3i\sqrt{3}}{2}$ $x = \frac{-1 \pm \sqrt{1 - 4(1)(1)}}{2} = \frac{-1 \pm i\sqrt{3}}{2}$

Calculator Exercises:

- Using your calculator, find all *real* solutions of: $\frac{1}{2}x^5 - \frac{1}{5}x^2 = -2$. Use BOTH methods of solving polynomials on your calculator. Verify that both methods give you the same answer(s).

$$x = -1.274$$

- The table shows how many minutes out of each eight-hour workday are used to pay one day's worth of taxes.

- Draw a scatter plot of the data (include a rough sketch on your paper)
- Graph several models (Linear, Quadratic, Cubic).
- Write the model equation for the curve that best fits the data.
- Based on this equation, how many minutes should you expect to work each day in the year 2020 to pay one day's taxes?



$$y_{LIN} = -1.35x + 2847.9$$

$$y_{QUAD} = -.74x^2 + 2965.7x - 2974590.3$$

$$y_{CUBIC} = .28x^3 - 1693.5x^2 + 3400352x - 2275825095$$

YEAR	MINUTES
2003	136
2004	137
2005	145
2006	150
2007	149
2008	139
2009	128
2010	129
2011	133

Cubic

$$y(2020) \approx 120.9$$

11. Divide using *Long Division*: $\frac{6x^5+5x^4+x^3-3x^2+x}{3x+1}$

12. Diving using *Synthetic Division*: $(z^4 - 3z^3 + 2z^2 - 4z + 4) \div (z - 1)$

$$\begin{array}{r}
 2x^4 + x^3 - x + \frac{2}{3} \\
 3x+1 \overline{) 6x^5+5x^4+x^3-3x^2+x+0} \\
 \underline{6x^5+2x^4} \\
 3x^4+x^3-3x^2+x \\
 \underline{3x^4+x^3} \\
 -3x^2+x \\
 \underline{-3x^2-x} \\
 2x+0 \\
 \underline{2x+\frac{1}{3}} \\
 -\frac{1}{3}
 \end{array}$$

$$\begin{array}{r|rrrrr}
 1 & 1 & -3 & 2 & -4 & 4 \\
 & & 1 & -2 & 0 & -4 \\
 \hline
 & 1 & -2 & 0 & -4 & 0
 \end{array}$$

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