

$i^2 = -1$
 $i^3 = -i$
 $i^4 = 1$
 $i^5 = i$
 $i^6 = -1$

1. Simplify the following.

a. $-4i^7$

$-4(-i) = 4i$

b. $(2i+3)(5i-2)$

$-16 + 11i$

c. $\sqrt{-32}$

$\sqrt{-1 \cdot 16 \cdot 2} = 4i\sqrt{2}$

d. $\sqrt{-12}$

$2i\sqrt{3}$

e. $-3\sqrt{-50}$

$-3\sqrt{-1 \cdot 25 \cdot 2}$
 $-3i \cdot 5\sqrt{2} = -15i\sqrt{2}$

f. $-3 + 5i - (20i + 10)$

$-3 + 5i - 20i - 10$
 $-13 - 15i$

g) $-3\sqrt{48}$
 $-3\sqrt{16 \cdot 3} = -12\sqrt{3}$

h) $4\sqrt{72}$
 $4\sqrt{36 \cdot 2} = 24\sqrt{2}$

2. Solve the following by factoring.

a. $(x+2)(2x-5) = 0$

$x = -2, \frac{5}{2}$

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

b. $x^2 + 3x - 18 = 0$

$(x-3)(x+6) = 0$
 $x = 3, -6$

c. $2x^2 - 3x - 10 = -11$

$2x^2 - 3x + 1 = 0$
 $(2x-1)(x+1) = 0$
 $x = \frac{1}{2}, -1$

d. $x^2 - 36 = 0$

$(x+6)(x-6) = 0$
 $x = 6, -6$

$\sqrt{x^2} = \sqrt{36}$
 $x = \pm 6$

e. $x^2 + 25 = 0$

$\sqrt{x^2} = \sqrt{-25}$
 $x = \pm 5i$

3. Solve the following with the Quadratic Formula.

a. $x^2 + x - 4 = 0$

$x = \frac{-1 \pm \sqrt{1^2 - 4(1)(-4)}}{2(1)}$
 $= \frac{-1 \pm \sqrt{1+16}}{2}$
 $x = \frac{-1 \pm \sqrt{17}}{2}$

b. $3x^2 + 10 = 4x$

$3x^2 - 4x + 10 = 0$
 $x = \frac{4 \pm \sqrt{(-4)^2 - 4(3)(10)}}{2(3)}$
 $= \frac{4 \pm \sqrt{-104}}{6} = \frac{4 \pm 2i\sqrt{26}}{6} = \frac{2 \pm i\sqrt{26}}{3}$

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

$x = \frac{-3 \pm \sqrt{3^2 - 4(2)(-2)}}{2(2)}$
 $= \frac{-3 \pm \sqrt{25}}{4}$
 $= \frac{-3 \pm 5}{4}$
 $x = \frac{1}{2}, -2$

4. If you know that $f(-4) = 0$, what does this tell you about the graph and the equation of $f(x)$?

$\rightarrow -4$ is an x-intercept on the graph
 $\rightarrow (x+4)$ is a factor of the $f(x)$ equation!

5. If $f(x) = 126x^2 - 6x^5 + 108x - 6x^3 - 30x^4$

a. Rewrite the equation in standard form

$$f(x) = -6x^5 - 30x^4 - 6x^3 + 126x^2 + 108x$$

b. State the degree. 5

c. How many roots? 5

d. Describe the left and right end behaviors.

ODD -

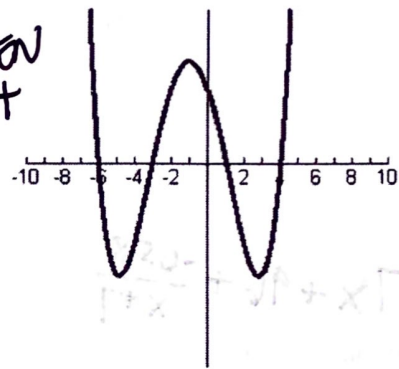
$$\begin{aligned} \text{R } x \rightarrow \infty & y \rightarrow -\infty \\ \text{L } x \rightarrow -\infty & y \rightarrow \infty \end{aligned}$$

e. Draw a rough sketch to show the general shape and orientation of the graph. Use your calculator to find the roots BUT do not copy the graph from your calculator!



6. Use the graph to write an equation in factored form.

EVEN +



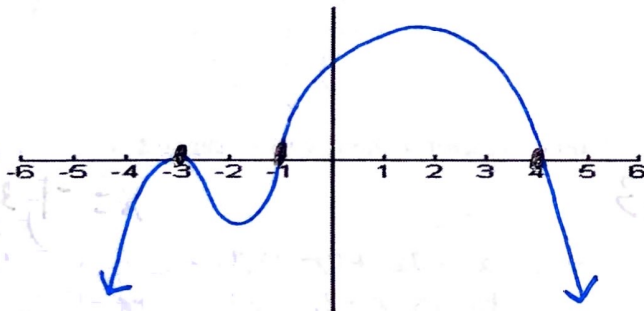
Equation

$$y = (x+6)(x+3)(x-1)(x-4)$$

7. Graph each polynomial equation.

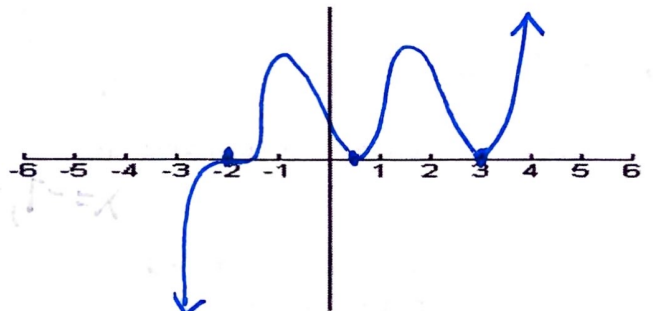
a. $y = -(x-4)(x+3)^2(x+1)$

EVEN (+)
-



b. $y = (x+2)^3(x-3)^2(2x-1)^2$

ODD +



8. Use the Remainder Theorem to evaluate each function at the given value. You must show all work.

a. $f(x) = x^5 + 6x^4 - 3x^2 - 2x - 9$
at $x = -5$

$$\begin{array}{r|rrrrrr} -5 & 1 & 6 & 0 & -3 & -2 & -9 \end{array}$$

$$\downarrow \begin{array}{r} -5 & -5 & 25 & -110 & 560 \end{array}$$

$$\begin{array}{r|rrrrr} 1 & 1 & -5 & 22 & -112 & 551 \end{array}$$

$$f(-5) = 551$$

b. $f(x) = x^4 + 6x^3 - 3x^2 + 22x - 29$
at $x = 2$

$$f(2) = 67$$

9. Divide.

a. $(x^3 + 47x + 14) \div (x + 7)$

$$\begin{array}{r|rrrr} -7 & 1 & 0 & 47 & 14 \\ \downarrow & -7 & 49 & -67 & 2 \end{array}$$

$$\begin{array}{r|rr} 1 & -7 & 96 & -658 \end{array}$$

$$x^2 - 7x + 96 + \frac{-658}{x+7}$$

b. $(10x^3 + 37x^2 + 37x + 6) \div (5x + 1)$

see sep. paper

Find all solutions. You may use your calculator initially, but must show work to support your answers.

10. $x^3 - 4x^2 - 9x + 36 = 0$ $x^2 - x - 12 = 0$

$$\begin{array}{r|rrrr} 3 & 1 & -4 & -9 & 36 \\ \downarrow & +3 & -3 & -36 & \end{array}$$

$$\begin{array}{r|rr} 1 & -1 & -12 & 0 \end{array}$$

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

$$x = 4, -3$$

11. $x^3 + 4x^2 + 2x - 28 = 0$

$$\begin{array}{r|rrrr} 2 & 1 & 4 & 2 & -28 \\ \downarrow & +2 & +12 & +28 & \end{array}$$

$$x^2 + 6x + 14 = 0$$

$$x = 2, -3 \pm i\sqrt{5}$$

One or more factors of the polynomial are given. Find all solutions. You must show work to support your answers.

12. $x^4 + 8x^3 - 2x^2 - 72x - 63$
Factor: $x - 3, x + 3 = 0$

$$x = -7, -3, -1, 3$$

$$\begin{array}{r|rrrr} 3 & 1 & 8 & -2 & -72 & -63 \\ \downarrow & 3 & 33 & 93 & 63 & \end{array}$$

$$\begin{array}{r|rr} 1 & 11 & 31 & 21 & 10 \\ \downarrow & -3 & -24 & -21 & \end{array}$$

13. $x^4 - 7x^3 + 8x^2 + 13x - 3$
Factors: $x - 3, x + 1$

$$x = 3, -1, 5 \pm \sqrt{2}$$

$$\begin{array}{r|rrrr} 3 & 1 & -7 & 8 & 13 & -3 \\ & 3 & -12 & -12 & 3 & \\ \hline -1 & 1 & -4 & -4 & 1 & 0 \\ & -1 & 5 & -1 & & \\ \hline & 1 & -5 & 1 & 0 & \end{array}$$

$$x^2 - 5x + 1 = 0 \rightarrow \text{QF}$$

9b

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

$$5x+1 \mid 10x^3 + 37x^2 + 37x + 6$$

$$2x^2(5x+1)$$

$$\begin{array}{r} (-) 10x^3 + 2x^2 \\ \hline \end{array}$$

$$\frac{10x^3}{5x} = 2x^2$$

$$35x^2 + 37x + 6$$

$$7x(5x+1)$$

$$\begin{array}{r} (-) 35x^2 + 7x \\ \hline \end{array}$$

$$\frac{35x^2}{5x} = 7x$$

$$30x + 6$$

$$6(5x+1)$$

$$\begin{array}{r} (-) 30x + 6 \\ \hline 0 \end{array}$$

$$\frac{30x}{5x} = 6$$

$2x^2 + 7x + 6$