Day 1 – Long Division

Use Polynomial Long Division to divide the following

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

$$x^2+4x+7+\frac{9}{x-1}$$

2. $(8x^2+34x-1)\div(4x-1)$

$$2x+9+\frac{8}{4x-1}$$

3. $(3x^3+11x^2+4x+1)\div(x^2+x)$

$$3x+8+\frac{-4x+1}{x^2+x}$$

4. $(7x^3+11x^2+7x+5)\div(x^2+1)$

$$7x+11+\frac{-6}{x^2+1}$$

5. $(5x^4-2x^3-7x^2-39)\div(x^2+2x-4)$

6. $(4x^4+5x-4)\div(x^2-3x-2)$

$$4x^2+12x+44+\frac{161x+84}{x^2-3x-2}$$

$$5x^2 - 12x + 37 + \frac{-122x+109}{x^2+2x-4}$$

7. $(x^2 - 4x + 15) + (-3x^2 + 6x - 12)$

$$-2x^2 + 2x + 3$$

8. $(2x^2 - 5x + 8) - (5x^2 - 7x - 7)$

$$-3x^2 + 2x + 15$$

Day 2 – Synthetic Division

Use Polynomial Synthetic Division to divide the following

1. $(2x^2 - 7x + 10) \div (x - 5)$

$$2x + 3 + \frac{25}{x-5}$$

2. $(4x^2 - 13x - 5) \div (x - 2)$

$$4x - 5 + \frac{-15}{x-2}$$

3. $(x^2 + 8x + 1) \div (x + 4)$

$$x + 4 + \frac{-15}{x+4}$$

4. $(x^2 + 9) \div (x - 3)$

$$x + 3 + \frac{18}{x-3}$$

5. $(x^3 - 5x^2 - 2) \div (x - 4)$

$$x^2 - x - 4 + \frac{-18}{x-4}$$

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

$$x^2 - 3x + 5 + \frac{-9}{x+3}$$

7. $(x^4 - 5x^3 - 8x^2 + 13x - 12) \div (x - 6)$

$$x^3 + x^2 - 2x + 1 + \frac{-6}{x-6}$$

8. $(x^4 + 4x^3 + 16x - 35) \div (x + 5)$

$$x^3 - x^2 + 5x - 9 + \frac{10}{x+5}$$

9.

$$\begin{array}{r|rrr} 2 & 1 & -5 & 3 \\ & & 2 & -6 \\ \hline & 1 & -3 & -3 \end{array}$$

$$\frac{x^3 - 5x + 3}{x - 2} = x^2 - 3x - \frac{3}{x - 2}$$

The polynomial is missing the x term, so you must add in *a* zero in that spot:

$$x^2 + 2x - 1 + \frac{1}{x-2}$$

Day 3 – Apply Remainder Theorem to Factor Polynomials

Given polynomial f(x) and a factor of f(x), factor f(x) completely.

1. $f(x) = x^3 - 10x^2 + 19x + 30; x - 6$

$f(x) = (x-6)(x-5)(x+1)$

2. $f(x) = x^3 - 2x^2 - 40x - 64; x - 8$

$f(x) = (x-8)(x+2)(x+4)$

3. $f(x) = x^3 + 18x^2 + 95x + 150; x + 10$

$f(x) = (x+3)(x+5)(x+10)$

4. $f(x) = x^3 - 9x^2 + 8x + 60; x + 2$

$f(x) = (x-6)(x-5)(x+2)$

5. $f(x) = 3x^3 - 2x^2 - 61x - 20; x - 5$

$f(x) = (x-5)(3x+1)(x+4)$

6. $f(x) = 2x^3 - 15x^2 + 34x - 21; x - 1$

$f(x) = (2x-7)(x-3)(x-1)$

7. $f(x) = 4x^3 - 25x^2 - 154x + 40; x - 10$

$$f(x) = (x+4)(4x-1)(x-10)$$

8. $f(x) = 3x^3 - 4x^2 - 28x - 16; x + 2$

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

Day 4 – Applying the Remainder to Solve Polynomials

If given polynomial f(x) and a factor of f(x), factor f(x) completely. If given polynomial function f(x) and a zero of f(x) find the other zeros.

1. $f(x) = x^3 - 2x^2 - 21x - 18$; -3

-1, 6

2. $f(x) = x^3 - 8x^2 + x + 42$; $(x-7)$

(x-3)(x+2)(x-7)

3. $f(x) = 10x^3 - 81x^2 + 71x + 42$; 7

-0.4, 1.5

4. $f(x) = 3x^3 + 28x^2 + 69x + 20$; -5

-1/3, -4

5. $f(x) = 2x^3 - 5x^2 - 196x + 99 \quad ; \frac{1}{2}$

-9, 11

6. $f(x) = x^3 + 11x^2 - 34x - 104 \quad ; -13$

2, -4

7. $f(x) = 14x^3 + 103x^2 + 111x - 18 \quad ; -6$

$\frac{1}{7}, -\frac{3}{2}$

8. $f(x) = 2x^3 - 10x^2 - 71x - 9 \quad ; 9$

$\frac{-4 \pm \sqrt{14}}{2}$

9. $f(x) = 2x^3 + 5x^2 - 32x - 80 \quad ; -\frac{5}{2}$

-4, 4

10. $f(x) = x^4 - 4x^3 - x + 4 \quad ; (x-4)$

(x-4)(x-1)(x^2 +x+1)

Day 5 – Review Day 1- 4

Divide the following polynomials using long division.

1. $\left(4x^4-17x^2+9x-18\right)\div\left(x^2-2\right)$

$4x^2-9+\dfrac{9x-36}{x^2-2}$

Divide the following polynomials using synthetic division.

2. $\left(5x^4+2x^2-15x+10\right)\div\left(x+2\right)$

$5x^3-10x^2+22x-59+\dfrac{128}{x+2}$

Divide the following polynomials.

3. $\left(2x^3-11x^2+13x-44\right)\div\left(x-5\right)$

$2x^2-x+8+\dfrac{-4}{x-5}$

4. $\left(x^4+2x^3-7x^2-14\right)\div\left(x+2\right)$

$x^3-7x+14+\dfrac{-42}{x+2}$

5. $\left(x^3-3x^2-x-10\right)\div\left(x^2+3x-1\right)$

$x-6+\dfrac{18x-16}{x^2+3x-1}$

6. $\left(2x^3+4x^2-5x+16\right)\div\left(x-3\right)$

$2x^3+10x+25+\dfrac{91}{x-3}$

Given polynomial *f*(*x*) and a factor of *f*(*x*), factor *f*(*x*) completely.

7. $f(x)=x^3-5x^2-2x+24; x+2$

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

8. $f(x)=x^3-11x^2+14x+80; x-8$

$f(x)=(x+2)(x-8)(x-5)$

9. $f(x)=9x^3-9x^2-4x+4; x-1$

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

10. $f(x)=2x^3+7x^2-33x-18; x+6$

$f(x)=(x+6)(2x+1)(x-3)$

Given polynomial *f*(*x*) and a zero of *f*(*x*), find the other zeros.

11. $f(x) = x^3 - 4x^2 - 11x + 30; x = 2$

$x = -3,\ 2,\ 5$

12. $f(x) = x^3 - 2x^2 - 19x + 20; 5$

$x = -4,\ 1,\ 5$

13. $f(x) = 2x^4 - 6x^3 - 2x^2 + 6x; x = 3$

$x = 0,\ \pm 1,\ 3$

14. $f(x) = 3x^3 + 2x^2 - 12x - 8; -2$

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

Day 6 – Finding Possible Zeros

Find all of the possible roots of the following polynomials.

1. $f(x) = x^4 - 6x^3 + 7x^2 + 6x - 8$

Factors of the constant term:

$\pm 1,\ \pm 2,\ \pm 4,\ \pm 8$

Factors of the leading coefficient:

$\pm 1,$

Possible rational zeros:

$\pm 1,\ \pm 2,\ \pm 4,\ \pm 8$

Simplified list of zeros:

$\pm 1,\ \pm 2,\ \pm 4,\ \pm 8$

2. $f(x) = x^3 + 5x^2 - 4x - 20$

Factors of the constant term:

$\pm 1,\ \pm 2,\ \pm 4,\ \pm 5,\ \pm 10,\ \pm 20$

Factors of the leading coefficient:

± 1

Possible rational zeros:

$\pm 1,\ \pm 2,\ \pm 4,\ \pm 5,\ \pm 10,\ \pm 20$

Simplified list of zeros:

$\pm 1,\ \pm 2,\ \pm 4,\ \pm 5,\ \pm 10,\ \pm 20$

3. $f(x) = x^4 - 9x^2 - 4x + 12$

$\pm 1,\ \pm 2,\ \pm 3,\ \pm 4,\ \pm 6,\ \pm 12$

4. $f(x) = x^3 - 7x^2 + 15x - 9$

$\pm 1,\ \pm 3,\ \pm 9$

5. $f(x) = x^3 - 2x^2 - 2x - 3$

$\pm 1,\ \pm 3$

6. $f(x) = x^4 + 4x^3 + 4x^2 + 64x - 192$

$\pm 1,\ \pm 3,\ \pm 9$

7. $f(x) = 2x^3 - 7x^2 - 17x + 10$

$\pm 1,\ \pm 2,\ \pm 5,\ \pm 10,\ \pm \frac{1}{2},\ \pm \frac{5}{2}$

8. $f(x) = 2x^3 - 3x^2 + 8x - 12$

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

9. $f(x) = 6x^3 + 11x^2 - 3x - 2$

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

10. $f(x) = 2x^4 + 13x^3 + 19x^2 - 10x - 24$

$\pm 1,\ \pm 2,\ \pm 3,\ \pm 4,\ \pm 6,\ \pm 12,\ \pm 24,\ \pm\frac{3}{2}$

Day 7 – Find Zeros when $a = 1$

Factor the following polynomials.

1. $f(x) = x^4 - 6x^3 + 7x^2 + 6x - 8$

$x = -1, 1, 2, 4$

2. $f(x) = x^3 + 5x^2 - 4x - 20$

$x = -5, -2, 2$

3. $f(x) = x^4 - 9x^2 - 4x + 12$

$x = -2, 1, 3$

4. $f(x) = x^3 - 7x^2 + 15x - 9$

$x = 1, 3$

5. $f(x) = x^3 - 2x^2 - 2x - 3$

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

6. $f(x) = x^4 + 4x^3 + 4x^2 + 64x - 192$

$x = \pm 4i, 2, 6$

Day 8 – Find Zeros when $a \neq 1$

Find all of the zeros

1. $f(x) = 2x^3 - 7x^2 - 17x + 10$

$x = -2, \frac{1}{2}, 5$

2. $f(x) = 2x^3 - 3x^2 + 8x - 12$

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

3. $f(x) = 6x^3 + 11x^2 - 3x - 2$

$x = -2, \frac{1}{2}, -\frac{1}{3}$

4. $f(x) = 2x^4 + 13x^3 + 19x^2 - 10x - 24$

$x = -4, -2, -\frac{3}{2}, 1$

5. $f(x) = 8x^4 + 2x^3 + 8x^2 - 78x - 20$

$x = -\frac{1}{4}, 2, -1 \pm 2i$

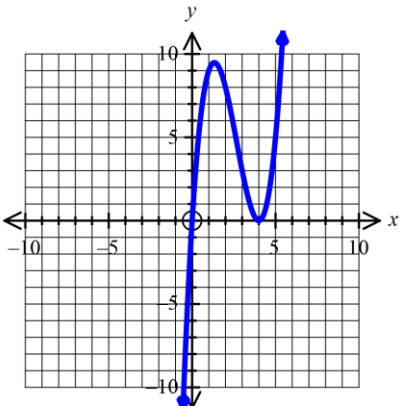
6. $f(x) = 36x^4 + 24x^3 - 41x^2 - 6x + 8$

$x = -\frac{4}{3}, -\frac{1}{2}, \frac{1}{2}, \frac{2}{3}$

Day 9 – Find Zeros via a Calculator

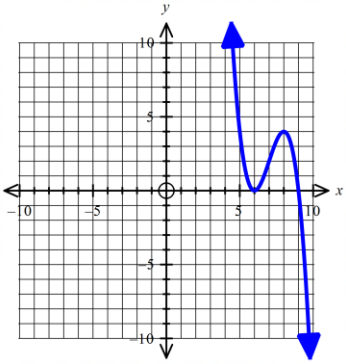
Using the Graph, find all the Real Zeros

1.



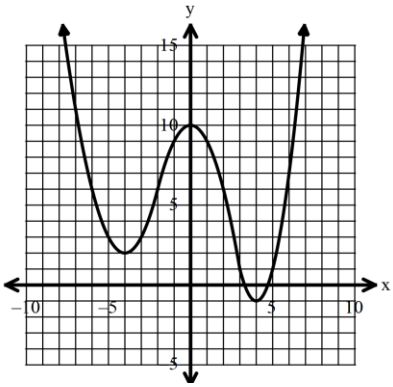
$x = 0, 4, 4$

2.



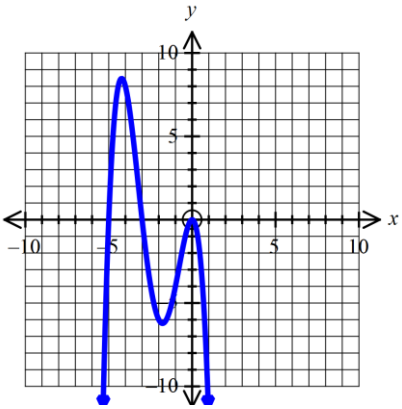
$x = 6, 6, 9$

3.



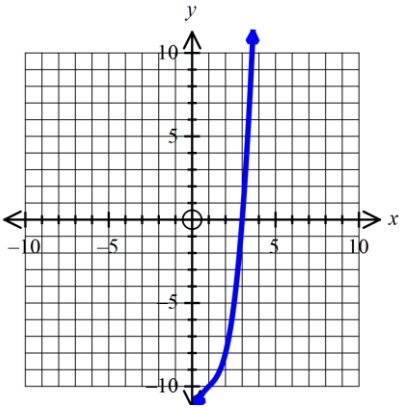
$x \approx 3.2, 4.8$

4.



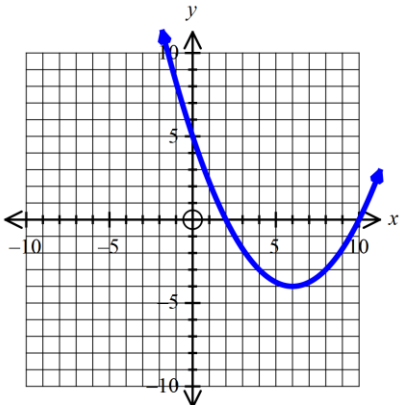
$x = -5, -3, 0, 0$

5.



$x = 3$

6.



$x = 2, 10$

Find the number of solutions or zeroes for each equation or function. Then look at the graph on a calculator decide how many real solutions and imaginary solutions there are.

7. $f(x) = x^3 - 2x^2 - 2x - 3$

Number of Solutions: 3

Number of Real Solutions: 1

Number of Imaginary Solutions: 2

8. $f(x) = 8x^4 + 2x^3 + 8x^2 - 78x - 20$

Number of Solutions: 4

Number of Real Solutions: 2

Number of Imaginary Solutions: 2

Find all the zeroes for each function below using a calculator

9. $f(x) = x^3 - 2x^2 - 21x - 18$

$x = -3, -1, 6$

10. $f(x) = 2x^4 + 13x^3 + 19x^2 - 10x - 24$

$x = -4, -2, -\frac{3}{2}, 1$

11. $f(x) = 6x^3 + 11x^2 - 3x - 2$

$x = -2, -\frac{1}{3}, \frac{1}{2}$