2.2 Synthetic Division Worksheet with solutions

This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

1) Calculate each of the following using synthetic division. Express your answer using the statement that could be used to check the division.

a) $x^3 - 7x - 6$ divided by $x - 3$

$$\begin{array}{r|rrrr} 3 & 1 & 0 & -7 & -6 \\ & & 3 & 9 & 6 \\ \hline & 1 & 3 & 2 & 0 \\ & x^2 & x & \# & R \end{array}$$

$$x^3 - 7x - 6 = (x-3)(x^2+3x+2)$$

b) $2x^3 - 7x^2 - 7x + 19$ divided by $x - 1$

$$\begin{array}{r|rrrr} 1 & 2 & -7 & -7 & 19 \\ & & 2 & -5 & -12 \\ \hline & 2 & -5 & -12 & 7 \\ & x^2 & x & \# & R \end{array}$$

$$2x^3 - 7x^2 - 7x + 19 = (x-1)(2x^2 - 5x - 12) + 7$$

c) $6x^4 + 13x^3 - 34x^2 - 47x + 28$ divided by $x + 3$

$$\begin{array}{r|rrrrr} -3 & 6 & 13 & -34 & -47 & 28 \\ & & -18 & 15 & 57 & -30 \\ \hline & 6 & -5 & -19 & 10 & -2 \\ & x^3 & x^2 & x & \# & R \end{array}$$

$$6x^4 + 13x^3 - 34x^2 - 47x + 28 = (x+3)(6x^3 - 5x^2 - 19x + 10) - 2$$

d) $2x^3 + x^2 - 22x + 20$ divided by $2x - 3$

$2x - 3 = 2\left(x - \frac{3}{2}\right) \rightarrow b = \frac{3}{2}$

$$\begin{array}{r|rrrr} \frac{3}{2} & 2 & 1 & -22 & 20 \\ & & 3 & 6 & -24 \\ \hline & 2 & 4 & -16 & -4 \\ & x^2 & x & \# & R \end{array}$$

$$\frac{2x^2 + 4x - 16}{2} = x^2 + 2x - 8$$

$$2x^3 + x^2 - 22x + 20 = (2x-3)(x^2 + 2x - 8) - 4$$

e) $12x^4 - 56x^3 + 59x^2 + 9x - 18$ divided by $2x + 1$

$2x + 1 = 2\left(x + \frac{1}{2}\right) \rightarrow b = -\frac{1}{2}$

$$\begin{array}{r|rrrrr} -\frac{1}{2} & 12 & -56 & 59 & 9 & -18 \\ & & -6 & 31 & -45 & 18 \\ \hline & 12 & -62 & 90 & -36 & 0 \\ & x^3 & x^2 & x & \# & R \end{array}$$

$$\frac{12x^3 - 62x^2 + 90x - 36}{2} = 6x^3 - 31x^2 + 45x - 18$$

$$12x^4 - 56x^3 + 59x^2 + 9x - 18 = (2x+1)(6x^3 - 31x^2 + 45x - 18)$$

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f) $6x^3 - 15x^2 - 2x + 5$ divided by $2x - 5$

$2x - 5 = 2\left(x - \frac{5}{2}\right) \rightarrow b = \frac{5}{2}$

$$\begin{array}{r|rrrr} \frac{5}{2} & 6 & -15 & -2 & 5 \\ & & 15 & 0 & -5 \\ \hline & 6 & 0 & -2 & 0 \\ & x^2 & x & \# & R \end{array}$$

$$\frac{6x^2 + 0x - 2}{2} = 3x^2 - 1$$

$$6x^3 - 15x^2 - 2x + 5 = (2x - 5)(3x^2 - 1)$$

g) $x^3 - 2x + 1$ divided by $x - 4$

$$\begin{array}{r|rrrr} 4 & 1 & 0 & -2 & 1 \\ & & 4 & 16 & 56 \\ \hline & 1 & 4 & 14 & 57 \\ & x^2 & x & \# & R \end{array}$$

$$x^3 - 2x + 1 = (x - 4)(x^2 + 4x + 14) + 57$$

h) $x^3 + 2x^2 - 6x + 1$ divided by $x + 2$

$$\begin{array}{r|rrrr} -2 & 1 & 2 & -6 & 1 \\ & & -2 & 0 & 12 \\ \hline & 1 & 0 & -6 & 13 \\ & x^2 & x & \# & R \end{array}$$

$$x^3 + 2x^2 - 6x + 1 = (x + 2)(x^2 - 6) + 13$$

2) Divide $x^4 - 16x^3 + 4x^2 + 10x - 11$ by each of the following binomials…

a) $x - 2$

$$\begin{array}{r|rrrrr} 2 & 1 & -16 & 4 & 10 & -11 \\ & & 2 & -28 & -48 & -76 \\ \hline & 1 & -14 & -24 & -38 & -87 \\ & x^3 & x^2 & x & \# & R \end{array}$$

$$x^4 - 16x^3 + 4x^2 + 10x - 11 = (x - 2)(x^3 - 14x^2 - 24x - 38) - 87$$

b) $x + 4$

$$\begin{array}{r|rrrrr} -4 & 1 & -16 & 4 & 10 & -11 \\ & & -4 & 80 & -336 & 1304 \\ \hline & 1 & -20 & 84 & -326 & 1293 \\ & x^3 & x^2 & x & \# & R \end{array}$$

$$x^4 - 16x^3 + 4x^2 + 10x - 11 = (x + 4)(x^3 - 20x^2 + 84x - 326) + 1293$$

3) Are either of the binomials in question #2 factors of $x^4 - 16x^3 + 4x^2 + 10x - 11$? Explain.

No, because dividing by each binomial leaves a non-zero remainder (-87 and 1293 respectively).

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