

Practice 7.2

Evaluate each function at the given value using synthetic substitution.

1.  $g(m) = m^3 - 10m^2 + 25m + 2$  at  $m = 6$ .

$$\begin{array}{r|rrrr} 6 & 1 & -10 & 25 & 2 \\ & & 6 & -24 & 6 \\ \hline & 1 & -4 & 1 & 8 \end{array}$$

$g(6) = 8$

2.  $f(x) = -x^3 - x + 24$  at  $x = 10$ .

$-x^3 + 0x^2 - x + 24$

$$\begin{array}{r|rrrr} 10 & -1 & 0 & -1 & 24 \\ & & -10 & -100 & -1010 \\ \hline & -1 & -10 & -101 & -986 \end{array}$$

$f(10) = -986$

3.  $r(t) = 3t^4 - 8t^2 - 11t + 2$  at  $t = -2$

$$\begin{array}{r|rrrrr} -2 & 3 & 0 & -8 & -11 & 2 \\ & & -6 & 12 & -8 & 38 \\ \hline & 3 & -6 & 4 & -19 & 40 \end{array}$$

$r(-2) = 40$

4.  $g(x) = 5x^4 + x^2 - x - 41$  at  $x = -5$

$$\begin{array}{r|rrrrr} -5 & 5 & 0 & 1 & -1 & -41 \\ & & -25 & 125 & -60 & 315 \\ \hline & 5 & -25 & 126 & -61 & 314 \end{array}$$

$g(-5) = 314$

Divide each polynomial using both long division and synthetic division. Remember, your answers should match ©

5.  $(n^4 + 3n^3 - 9n - 38) \div (n + 3)$

**Long Division**

$$\begin{array}{r} n^3 + 0n^2 + 0n - 9 - \frac{11}{n+3} \\ n+3 \overline{) n^4 + 3n^3 + 0n^2 - 9n - 38} \\ \underline{-n^4 + 3n^3} \phantom{0n^2} \\ 0n^3 + 0n^2 - 9n - 38 \\ \underline{-0n^3 + 0n^2} \phantom{-9n} \\ 0n^2 - 9n - 38 \\ \underline{-0n^2 + 0n} \phantom{-38} \\ -9n - 38 \\ \underline{-9n - 27} \\ -11 \end{array}$$

**Synthetic Division**

$$\begin{array}{r|rrrrr} -3 & 1 & 3 & 0 & -9 & -38 \\ & & -3 & 0 & 0 & 27 \\ \hline & 1 & 0 & 0 & -9 & -11 \end{array}$$

$= n^3 + 0n^2 + 0n - 9 - \frac{11}{n+3}$

Is  $(n + 3)$  a factor of the function? **NOPE!** ↗

6.  $(x^4 + 16x^3 + 75x^2 + 91x + 49) \div (x + 7)$

**Long Division**

$$\begin{array}{r} x^3 + 9x^2 + 12x + 7 \\ x+7 \overline{) x^4 + 16x^3 + 75x^2 + 91x + 49} \\ \underline{-x^4 + 7x^3} \phantom{0x^2} \\ 9x^3 + 75x^2 + 91x + 49 \\ \underline{-9x^3 + 63x^2} \phantom{91x} \\ 12x^2 + 91x + 49 \\ \underline{-12x^2 + 84x} \phantom{49} \\ 7x + 49 \\ \underline{-7x + 49} \\ 0 \end{array}$$

**Synthetic Division**

$$\begin{array}{r|rrrrr} -7 & 1 & 16 & 75 & 91 & 49 \\ & & -7 & -63 & -84 & -49 \\ \hline & 1 & 9 & 12 & 7 & 0 \end{array}$$

$= x^3 + 9x^2 + 12x + 7$

Is  $n = -7$  a zero of the function? **yes because  $(x+7)$  is a factor!**

# 7.2 - Synthetic and Long Polynomial Division 4

7.  $(4a^3 - 36a^2 + 60a + 72) \div (a - 6)$

**Long Division**

$$\begin{array}{r}
 4a^2 - 12a - 12 \\
 a-6 \overline{) 4a^3 - 36a^2 + 60a + 72} \\
 \underline{4a^3 - 24a^2} \phantom{+ 60a + 72} \\
 -12a^2 + 60a \phantom{+ 72} \\
 \underline{-12a^2 + 72a} \phantom{+ 72} \\
 -12a + 72 \\
 \underline{-12a + 72} \\
 0
 \end{array}$$

**Synthetic Division**

$$\begin{array}{r|rrrr}
 6 & 4 & -36 & 60 & 72 \\
 & \times & 24 & -72 & -72 \\
 \hline
 & 4 & -12 & -12 & 0
 \end{array}$$

$4x^2 - 12x - 12$  yes because  $(a-6)$  is a factor!

Is  $a = 6$  a zero of the function?  $\rightarrow$  factor!

8.  $(b^4 - 4b^3 + 5b^2 + 8b - 14) \div (b - 2)$

**Long Division**

$$\begin{array}{r}
 b^3 - 2b^2 + b + 10 + \frac{6}{b-2} \\
 b-2 \overline{) b^4 - 4b^3 + 5b^2 + 8b - 14} \\
 \underline{-b^4 - 2b^3} \phantom{+ 5b^2 + 8b - 14} \\
 -2b^3 + 5b^2 \phantom{+ 8b - 14} \\
 \underline{-2b^3 + 4b^2} \phantom{+ 8b - 14} \\
 b^2 + 8b \phantom{+ 8b - 14} \\
 \underline{b^2 - 2b} \phantom{+ 8b - 14} \\
 10b - 14 \\
 \underline{-10b + 20} \\
 6
 \end{array}$$

**Synthetic Division**

$$\begin{array}{r|rrrrr}
 2 & 1 & -4 & 5 & 8 & -14 \\
 & \times & 2 & -4 & 2 & 20 \\
 \hline
 & 1 & -2 & 1 & 10 & 6
 \end{array}$$

$b^3 - 2b^2 + b + 10 + \frac{6}{b-2}$

Is  $b = 2$  a zero of the function? **NOPE!**

Factor each polynomial completely. I'm a nice guy, so I'll give you one of the factors. You answer for each should consist of 3 binomials.

9.  $f(x) = 5x^3 - 18x^2 - 33x - 10$  (One factor is  $x - 5$ .)

$$\begin{array}{r|rrrr}
 5 & 5 & -18 & -33 & -10 \\
 & \times & 25 & 35 & 10 \\
 \hline
 & 5 & 7 & 2 & 0 \\
 & 5x^2 + 7x + 2
 \end{array}$$

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

$\Rightarrow (x-5)(5x+2)(x+1)$

10.  $f(x) = 25x^3 - 40x^2 + 17x - 2$  (One factor is  $x - 1$ .)

$$\begin{array}{r|rrrr}
 1 & 25 & -40 & 17 & -2 \\
 & \times & 25 & -15 & 2 \\
 \hline
 & 25 & -15 & 2 & 0 \\
 & 25x^2 - 15x + 2
 \end{array}$$

$(5x-2)(5x-1)$

$\Rightarrow (x-1)(5x-2)(5x-1)$

Find all the zeros of the given polynomial. I'm still a nice guy, so I'll give you one of the zeros.

11.  $f(x) = 15x^3 - 28x^2 + 15x - 2$  (One zero is  $x = 1$ .)

$$\begin{array}{r|rrrr}
 1 & 15 & -28 & 15 & -2 \\
 & \times & 15 & -13 & 2 \\
 \hline
 & 15 & -13 & 2 & 0 \\
 & 15x^2 - 13x + 2
 \end{array}$$

$(3x-2)(5x-1)$

$3x-1=0 \Rightarrow x=\frac{1}{3}$

$5x-1=0 \Rightarrow x=\frac{1}{5}$

$\left\{ 1, \frac{2}{3}, \frac{1}{5} \right\}$

12.  $f(x) = 9x^3 + 3x^2 - 5x + 1$  (One zero is  $x = -1$ .)

$$\begin{array}{r|rrrr}
 -1 & 9 & 3 & -5 & 1 \\
 & \times & -9 & 6 & -1 \\
 \hline
 & 9 & -6 & 1 & 0 \\
 & 9x^2 - 6x + 1
 \end{array}$$

$3x-1=0 \Rightarrow x=\frac{1}{3}$

$3x-1=0 \Rightarrow x=\frac{1}{3}$

$\Rightarrow \left\{ \frac{1}{3}, \frac{1}{3}, -1 \right\}$