# Remember Long Division?

$$
\begin{array}{r}
17 \\
7 \,\overline{)\,119} \\
-7\phantom{9} \\
\hline
49 \\
-49 \\
\hline
0
\end{array}
\qquad\qquad
\begin{array}{r}
24 \\
13 \,\overline{)\,316} \\
-26\phantom{6}\downarrow \\
\hline
56 \\
-52 \\
\hline
4 \rightarrow R
\end{array}
$$

We can do the same with functions

$$
\begin{array}{r l}
 & x^2 + x - 2 \\
x + 1 \,\big)\!\! & \overline{x^3 + 2x^2 - x - 12} \\
 & -\,x^3 + x^2 \\
 & \overline{\emptyset \quad\; x^2 - x} \\
 & \quad -(x^2 + x) \\
 & \quad \overline{\emptyset \quad -2x - 12} \\
 & \qquad -\;-2x - 2 \\
 & \qquad \overline{\qquad -10}
\end{array}
$$

R = -10

a) Divide $4x^3 + 9x - 12$ by $2x + 1$

b) Write a statement that can be used to check your division

$$\begin{array}{r}
2x^2 - x + 5 \\
2x+1\overline{)\,4x^3 + 0x^2 + 9x - 12} \\
-\underline{(4x^3 + 2x^2)} \qquad\qquad \\
-2x^2 + 9x \qquad \\
-\underline{(-2x^2 - x)} \qquad \\
10x - 12 \\
-\underline{(10x + 5)} \\
-17
\end{array}$$

AND.

$$4x^3 + 9x - 12 = (2x+1)(2x^2 - x + 5) - 17$$

$$\vdots$$

$$= \underline{4x^3 + 9x - 12}$$

# Checking your Division

The result of the division of a polynomial, $P(x)$ by a binomial $(x-b)$ is $\frac{P(x)}{x-b} = Q(x) + \frac{R}{x-b}$

where $Q(x)$ is the quotient and $R$ is the remainder and.

$$\boxed{P(x) = Q(x) \cdot (x-b) + R}$$

can be used to check.

The volume of a rectangular prism can be given by
$V(x) = x^3 + 7x^2 + 14x + 8$

$\text{Vol} = l \cdot w \cdot h$

If the height of the prism is x + 2, determine the length and width of the prism

$$
\begin{array}{r}
x^2 + 5x + 4 \\
x+2 \overline{) x^3 + 7x^2 + 14x + 8} \\
-\ x^2 + 2x^2 \\
\hline
5x^2 + 14x \\
-\ 5x^2 + 10x \\
\hline
4x + 8 \\
4x + 8 \\
\hline
0
\end{array}
$$

$$x^2 + 7x^2 + 14x + 8 = \underbrace{(x+2)}_{h}\underbrace{(x^2 + 5x + 4)}_{l \cdot w}$$

⊗ 4
⊕ 5

$$(x+2)(x+4)(x+1)$$

# Remainder Theorem

When a polynomial function $P(x)$ is divided by $x-b$ the remainder will be $P(b)$

Also, if $P(x)$ is divided by $(ax-b)$, the remainder will be $P\left(\frac{b}{a}\right)$

Use the remainder theorem to determine the remainder when $G(x) = 2x^3 + x^2 - 3x - 6$ is divided by:

a) $x + 1$

b) $2x - 5$

a) $G(-1) = 2(-1)^3 + (-1)^2 - 3(-1) - 6$
$= -2 + 1 + 3 - 6$
$= -4$

b) $G(\frac{5}{2}) = 2(\frac{5}{2})^3 + (\frac{5}{2})^2 - 3(\frac{5}{2}) - 6$
$= 2(\frac{125}{8}) + (\frac{25}{4}) - \frac{15}{2} - 6$
$= \frac{125}{4} + \frac{25}{4} - \frac{30}{4} - \frac{24}{4}$
$= \frac{96}{4}$
$= 24$

# Homework
# pg. 91 # 3, 6, 9, 10, 12