Recall...

If a number divides into another number evenly, the divisor is a factor of the larger number.

For example-
12/4 = 3
There is no remainder, so 4 is a factor of 12, as is 3

$$4\overline{)12}\,.\,3$$

Dividing evenly (with no remainder) enables us to factor the dividend. The divisor (here, 4) and quotient (3) are factors of 12.

We will do the same with polynomials that we can't factor using one of our methods.

Consider...

$$
\begin{array}{r}
36 \\
3\overline{)108} \\
-\ 9 \\
\hline
18 \\
-\ 18 \\
\hline
0
\end{array}
$$

$$
\begin{array}{r}
36\frac{2}{3} \\
3\overline{)110} \\
9 \\
\hline
20 \\
-\ 18 \\
\hline
2
\end{array}
$$

Sec 3.3

Dividing Polynomials- Long Division

Divide $x^2 + 10x + 21$ by $x+3$

$$
\begin{array}{r}
x+7 \\
x+3 \overline{)\, x^2+10x+21} \\
-(x^2+3x) \\
\hline
7x+21 \\
-(7x+21) \\
\hline
0
\end{array}
$$

$x^2+10x+21$

$(x+7)(x+3)$

Divide 4 $-5x-x^2+6x^3$ by $3x-2$

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

$$3x-2\overline{)6x^3-x^2-5x+4}$$

$$-(6x^3-4x^2)$$

$$3x^2-5x$$

$$-(3x^2-2x)$$

$$-3x+4$$

$$-(-3x+2)$$

$$2$$

answer

quotient + (remainder/divisor)

Divide $6x^4 + 5x^3 + 3x - 5$ by $3x^2 - 2x$

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

$$3x^2 - 2x \overline{)\, 6x^4 + 5x^3 + 3x - 5}$$

$$-(6x^4 - 4x^3)$$

$$9x^3 + 0x^2$$

$$-(9x^3 - 6x^2)$$

$$6x^2$$

$$-\,6x^2$$

$$3x$$

Suggested Practice
Sec 3.3, page 373
1-16 odd

students find #15 tricky....please attempt...

1. $x+3$

3. x^2+3x+1

5. $2x^2+3x+5$

7. $4x+3+\frac{2}{3x-2}$

9. $2x^2+x+6-\frac{38}{x+3}$

11. $4x^3+16x^2+60x+246+\frac{984}{x-4}$

13. $2x+5$

15. $6x^2+3x-1-\frac{3x-1}{3x^2+1}$