

Notes **3.5**

Warmup – Factor each quadratic expression.

1. $x^2 + 7x + 12$

$$(x+3)(x+4)$$

2. $x^2 + 2x - 15$

$$(x+5)(x-3)$$

3. $x^2 - 11x + 24$

$$(x-8)(x-3)$$

4. $x^2 - 5x - 36$

$$(x-9)(x+4)$$

5. $2x^2 - 2x - 12$

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

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

6. $x^2 - 16$

$$(x+4)(x-4)$$

Investigation

Compare $1452 \div 12$

and

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

How do you think dividing them is similar?

$$\begin{array}{r}
 121 \\
 12 \overline{) 1452} \\
 \underline{12} \\
 25 \\
 \underline{24} \\
 12
 \end{array}$$

$$\begin{array}{r}
 x^2 + 2x + 1 \\
 x+2 \overline{) x^3 + 4x^2 + 5x + 2} \\
 \underline{x^3 + 2x^2} \\
 2x^2 + 5x \\
 \underline{2x^2 + 4x} \\
 x + 2 \\
 \underline{x + 2} \\
 0
 \end{array}$$

Same process

Now try $(x^3 - 3x^2 - 13x + 15) \div (x - 1)$

$$\begin{array}{r} x-1 \overline{) x^3 - 3x^2 - 13x + 15} \\ \underline{x^3 - 1x^2} \\ -2x^2 - 13x \\ \underline{-2x^2 + 2x} \\ -15x + 15 \\ \underline{-15x + 15} \\ 0 \end{array}$$

$$x \cdot x^2 = x^3$$

$$x \cdot -2x = -2x^2$$

$$x \cdot -15 = -15x$$

Line up like terms!

If there are missing terms, fill them in with zero place value holders

$$x^2 - 9 \Rightarrow x^2 + 0x - 9$$

Is $(x - 1)$ a factor of $(x^3 - 3x^2 - 13x + 15)$? How can you tell?

Yes, because there is no remainder.

If there is a remainder, your answer should look like:

$$\text{quotient} + \frac{\text{remainder}}{\text{divisor}}$$

Practice:

a. $(x^3 + 6x^2 + 13x + 12) \div (x + 3)$

$$\begin{array}{r} x^2 + 3x + 4 \\ x+3 \overline{) x^3 + 6x^2 + 13x + 12} \\ \underline{x^3 + 3x^2} \downarrow \\ 3x^2 + 13x \\ \underline{3x^2 + 9x} \\ 4x + 12 \\ \underline{4x + 12} \\ 0 \end{array}$$

$$\boxed{x^2 + 3x + 4}$$

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

$$\begin{array}{r} x^2 - 2x - 2 \\ x-2 \overline{) x^3 - 4x^2 + 2x + 5} \\ \underline{x^3 - 2x^2} \\ -2x^2 + 2x \\ \underline{-2x^2 + 4x} \\ -2x + 5 \\ \underline{-2x + 4} \\ 1 \end{array}$$

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

c. $(6x^3 - 11x^2 - 4x + 5) \div (2x - 1)$

$$\begin{array}{r} 3x^2 - 4x - 4 \\ 2x-1 \overline{) 6x^3 - 11x^2 - 4x + 5} \\ \underline{6x^3 - 3x^2} \\ -8x^2 - 4x \\ \underline{-8x^2 + 4x} \\ -8x + 5 \\ \underline{-8x + 4} \\ 1 \end{array}$$

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

d. $(x^4 - 23x^3 + 49x + 4) \div (x^2 + x + 2)$

$$\begin{array}{r} x^2 - 24x + 22 \\ x^2+x+2 \overline{) x^4 - 23x^3 + 0x^2 + 49x + 4} \\ \underline{x^4 + x^3 + 2x^2} \\ -24x^3 - 2x^2 + 49x \\ \underline{-24x^3 - 24x^2 - 48x} \\ 22x^2 + 97x + 4 \\ \underline{22x^2 + 22x + 44} \\ 75x - 40 \end{array}$$

$$x^2 - 24x + 22 + \frac{75x-40}{x^2+x+2}$$