## **Division of Polynomials**

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## **Division by a Monomial**

**Dividing a Polynomial by a Monomial** 

If a, b, and c are polynomials such that  $c \neq 0$ , then

$$\underbrace{EX}_{-} \cdot \frac{2}{7} + \frac{3}{7} = \frac{2+3}{7} = \frac{5}{7} \qquad \frac{a+b}{c} = \frac{a}{c} + \frac{b}{c} \text{ Similarly, } \frac{a-b}{c} = \frac{a}{c} - \frac{b}{c}$$

To divide a polynomial by a monomial, divide each individual term in the polynomial Note: by the divisor and simplify the result.

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For exercises 1 - 4, divide the polynomials .

1. 
$$(4x^4 + 8x^2 - 2) \div (-2)$$
  
 $4 \cdot x^4 \div 8 \cdot x^2 - 2 = \frac{4 \cdot x^4}{-2} \div \frac{8 \cdot x^2}{-2} - \frac{2}{-2}$   
 $= \sqrt{-2 \cdot x^4} - 4 \cdot x^2 \div \sqrt{-2}$ 

3. 
$$(25y^2 - 10y + 5) \div (5y^2)$$

$$2. \frac{7k^{4} - 5k^{3} + 4k^{2}}{k^{2}} = \frac{7k^{4} - 5k^{3} + 4k^{2}}{k^{2}}$$

$$= \frac{7k^{4}}{k^{2}} - \frac{5k^{3}}{k^{2}} + \frac{4k^{2}}{k^{2}}$$

$$= \frac{7k^{2}}{k^{2}} - \frac{5k^{3}}{k^{2}} + \frac{4k^{2}}{k^{2}}$$

$$= \frac{7k^{2}}{k^{2}} - \frac{5k^{3}}{k^{2}} + \frac{4}{k}$$

$$4. \frac{-x^{3}y - x^{2}y^{2} - xy^{3}}{-x^{2}y^{2}}$$

$$= \frac{-x^{3}y - x^{2}y^{2} - xy^{3}}{-x^{2}y^{2}}$$

$$= \frac{-x^{3}y - x^{2}y^{2}}{-x^{2}y^{2}} - \frac{xy^{3}}{-x^{2}y^{2}}$$

Ex.  
Ex.  
Divide 
$$\frac{379}{12}$$
 is denominator has 2  
or more terms  
is a l  
Divide  $\frac{379}{12}$  is a l  
is a l

$$\frac{3x + (1)}{x + 2} + \frac{3x + (1)}{3x^{2} + 7x + 9} - (3x^{2} + 6x) + (3x^{2} + 6x) + (x + 9) - (x + 2)$$

$$\frac{3x^{2} + 7x + 9}{x + 2} = \frac{3x + 1 + \frac{7}{x + 2}}{7}$$

x (?)= 32 anewer: 3x

$$\frac{E_{x}}{x} = \frac{7^{2} - 4x + 14}{x - 5}$$

$$\frac{x^{3} - 4x^{2} + x + 14}{x - 5}$$

$$\frac{x^{3} - 4x^{2} + x + 14}{x - 5}$$

$$\frac{x^{3} - 6x^{2} + x + 14}{(9 - 4x)^{2} + 5x}$$

$$\frac{-4x + 14}{(9 - 4x)^{2} + 5x}$$

$$\frac{-4x + 14}{(9 - 4x)^{2} + 5x}$$

$$\frac{-4x + 14}{(1 - 4x)^{2} + 5x}$$

$$\frac{-4x + 14}{(1 - 4x)^{2} + 5x}$$

Check previous example by multiplying:  

$$(\chi - \Im)(\chi - \chi - 4) - 6$$

$$= \chi^{3} - \chi^{2} - 4\chi$$

$$-5\chi^{2} + 5\chi + 20 - 6$$

$$= \chi^{3} - le\chi^{2} + \chi + 14$$

If the divisor has two or more terms, a *long division* process similar to the division of real numbers is used.

The solution to a long division problem is usually written in the form:  $quotient + \frac{remainder}{divisior}$ 

TIP: Recall that

- Long division is used when the divisor has two or more terms.
- If the divisor has one term, then divide each term in the dividend by the monomial divisor.

5. **a.** Divide 
$$(c^2 + 6c - 18) \div (c + 8)$$

Write our answer:

$$\frac{C^{2} + 6c - 18}{C + 8} = \frac{C - 2 + \frac{-2}{C + 8}}{C + 8}$$
$$= \frac{C - 2 - \frac{2}{C + 8}}{C + 8}$$

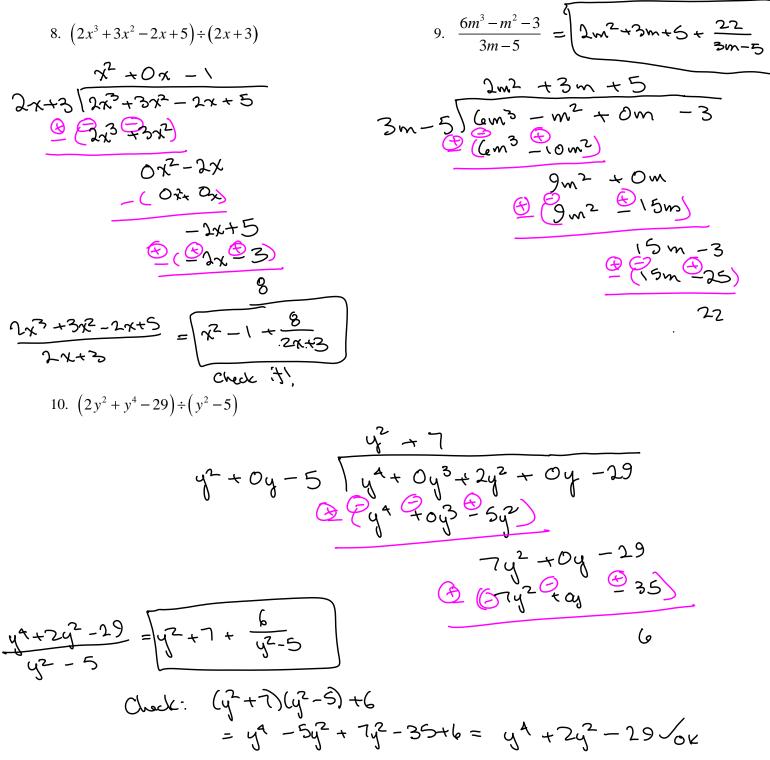
 $\begin{array}{c} c - \lambda \\ c + 8 \end{array} \\ \hline c^{2} + 6 c - 18 \\ \hline c^{2} + 8 c \end{array} \\ \hline - 2 c - 18 \\ \hline e (-2 c - 16) \\ \hline - 2 \end{array} \\ \hline - 2 \end{array}$ 

**b.** Check by multiplying the quotient by the divisor and adding the remainder.

$$D:v:derd = (Q:ot:ent)(D:v:sor) + Remainder(c-2)(c+3) - 2= c(c+3) - 2(c+3) - 2= c^2 + 3c - 2c - 16 - 2 = c^2 + 6c - 18 vok!$$

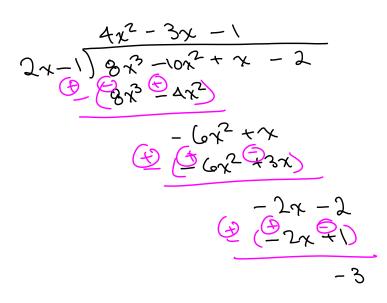
For exercises 6 - 10, divide the polynomials.

6. 
$$\frac{y^{2}-2y+3}{y+1} = (y-3+\frac{6}{y+1})$$
7. 
$$(6w^{2}+w-2)\div(3w+2)$$
7. 
$$(6w^{2}+w-2)$$
7.



11. There are two methods for dividing polynomials. When is long division necessary?

Example: Divide, 
$$8x^3 - 10x^2 + x - 2$$
  
 $2x - 1$ 



$$\frac{8x^{3}-10x^{2}+x-2}{2x-1} = \frac{4x^{2}-3x-1+\frac{-3}{2x-1}}{= \frac{4x^{2}-3x-1-\frac{3}{2x-1}}{2x-1}}$$

Check: 
$$(2x-1)(4x^2 - 3x-1) - 3$$
  
=  $8x^3 - (4x^2 - 2x)$   
 $- 4x^2 + 3x + 1 - 3$   
=  $8x^3 - 10x^2 + x - 2$  Vok

For exercises 12 - 15, determine which method to use to divide the polynomials: monomial division or long division. Then use that method to divide the polynomials.

12. 
$$\frac{4a^5 - 8a^3 + 2a}{2a}$$
 13.  $(8n^3 - 27) \div (2n - 3)$ 

14.  $(h^4 + 2h^2 - 5) \div (h^2 + 3)$  15.  $(6r^3 - 12r^2 + 9r - 3) \div (-3r^2)$