

11.3 Dividing Polynomials

Bell Ringer, "Solve it" on pg. 678

$$\frac{\text{SA of lg. can}}{\text{SA of sm. can}} = \frac{2\pi r^2 + 2\pi rh}{2\pi r^2 + 2\pi rh} = \frac{2\pi(2r)^2 + 2\pi(2r)2h}{2\pi r^2 + 2\pi rh}$$

$$\frac{8\pi r^2 + 8\pi rh}{2\pi r^2 + 2\pi rh} = \frac{4 \cdot 2\pi r(r+h)}{2\pi r(r+h)} = \frac{4}{1}$$

The ratio is 4:1

* A quotient of a polynomial and a monomial has 2 forms (both which are correct)

Example: $(x+y) \div z$

$$\frac{x+y}{z} \quad \text{or} \quad \frac{x}{z} + \frac{y}{z}$$

* Review Problem 1 on pg. 678

* Got it #1

$$A) (4a^3 + 10a^2 + 3a) \div 2a^2 \quad B) (5b^4 - 15b^2 + 1) \div 5b^3$$

$$\frac{4a^3 + 10a^2 + 3a}{2a^2}$$

$$\frac{5b^4 - 15b^2 + 1}{5b^3}$$

$$\frac{4a^3}{2a^2} + \frac{10a^2}{2a^2} + \frac{3a}{2a^2}$$

$$\frac{5b^4}{5b^3} - \frac{15b^2}{5b^3} + \frac{1}{5b^3}$$

$$\frac{2a}{1} + \frac{5}{1} + \frac{3}{2a}$$

$$\frac{b}{1} - \frac{3}{b} + \frac{1}{5b^3}$$

$$2a + 5 + \frac{3}{2a}$$

$$b - \frac{3}{b} + \frac{1}{5b^3}$$

$$C) (12c^4 + 18c^2 + 9c) \div 6c$$

$$\frac{12c^4 + 18c^2 + 9c}{6c}$$

$$\frac{12c^4}{6c} + \frac{18c^2}{6c} + \frac{9c}{6c}$$

$$2c^3 + 3c + \frac{3}{2}$$

* Dividing by a Binomial - is similar to long division (when the divisor is not a monomial, use long division.)

* make sure your dividen is listed in standard form (descending order) before you perform the long division.

* Remainder Long Division

Example $172 \div 13$

quotient
divisor $\overline{)}$ dividend

$$\begin{array}{r} 13 \overline{)172} \\ \underline{13} \\ 42 \\ \underline{39} \\ 3 \end{array}$$

or

$$13 \frac{3}{13}$$

or

* Review Problem 2 on pg. 679

$$13 + \frac{3}{13}$$

Got it #2) $(2m^2 - m - 3) \div (m+1)$

make sure
to put the
subtraction
sign in to help
you keep the
signs
correct.

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

Answer:
 $(2m-3)$

Check your work $(m+1)(2m-3)$
 $2m^2 - 3m + 2m - 3$
 $2m^2 - m - 3 \checkmark$

Other Examples:

* $(x^2 + 3x + 2) \div (x+1)$

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

Answer:
 $(x+2)$

Check: $(x+1)(x+2)$
 $x^2 + 2x + 1x + 2$
 $x^2 + 3x + 2$

* Review Problem 3 on pg. 679

* Got it #3

A) $(q^4 + q^2 + q - 3) \div (q - 1)$

* "0" as a
place holder
for any
missing
terms

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

Answer:

$$q^3 + q^2 + 2q + 3$$

check: $(q-1)(q^3 + q^2 + 2q + 3)$

$$q(q^3 + q^2 + 2q + 3) - 1(q^3 + q^2 + 2q + 3)$$

$$q^4 + q^3 + 2q^2 + 3q - q^3 - q^2 - 2q - 3$$

$$q^4 + q^2 + q - 3$$

Got it 3B)
on the other
sheet

* Review Problem 4 on pg. 680

* Got it #4) $(-10x - 1 + 4x^2) \div (-3 + 2x)$

$$\begin{array}{r} 2x-2 \\ 2x-3 \overline{) 4x^2 - 10x - 1} \\ \underline{-4x^2 - 6x} \\ -4x - 1 \\ \underline{-(-4x + 6)} \\ -7 \end{array}$$

Answer

$$2x-2 - \frac{7}{2x-3}$$

* Review Table "Concept Summary" on pg. 680



→ Check: $(2x-3)(2x-2) - 7$

$$(4x^2 - 4x - 6x + 6) - 7$$

$$(4x^2 - 10x + 6) - 7$$

$$4x^2 - 10x - 1 \checkmark$$

(2x-3)(2x-2)
-7

4x^2 - 10x - 1

Got it #3

B)

$$\begin{array}{r} h^2 - 3h + 5 \\ h+3 \overline{) h^3 + 0h^2 - 4h + 12} \\ \underline{- h^3 + 3h^2} \\ -3h^2 - 4h \\ \underline{- -3h^2 - 9h} \\ 5h + 12 \\ \underline{- 5h + 15} \\ -3 \end{array}$$

Answer:

$$h^2 - 3h + 5 - \frac{3}{h+3}$$

Check: $\left((h+3)(h^2 - 3h + 5) \right) - 3$

$$\left(h(h^2 - 3h + 5) + 3(h^2 - 3h + 5) \right) - 3$$

$$\left(h^3 - 3h^2 + 5h + 3h^2 - 9h + 15 \right) - 3$$

$$h^3 - 4h + 12 \checkmark$$

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11.3 pg. 681 #9-29 odd #33

$$9) \frac{12x^8 - 8x^3}{4x^4} = \frac{12x^8}{4x^4} - \frac{8x^3}{4x^4} = \frac{3x^4 - 2}{x}$$

$$11) \frac{n^5 - 18n^4 + 3n^3}{n^3} = n^2 - 18n + 3$$

$$13) \frac{7t^5 + 14t^4 - 28t^3 + 35t^2}{7t^2} = t^3 + 2t^2 - 4t + 5$$

$$15) \frac{21t^5 + 3t^4 - 11t^3}{7t^3} = 3t^2 + \frac{3}{7}t - \frac{11}{7}$$

$$17) \begin{array}{r} y-3 \\ y+2 \overline{) y^2 - y + 2} \\ \underline{-(y^2 + 2y)} \\ -3y + 2 \\ \underline{-(-3y - 6)} \\ -8 \end{array} \quad y-3 + \frac{8}{y+2}$$

Check: $(y-3)(y+2) + 8$
 $y^2 + 2y - 3y - 6 + 8$
 $y^2 - y - 6 + 8$
 $y^2 - y + 2 \checkmark$

19)

$$\begin{array}{r}
 -2q-10 \\
 2q+1 \overline{) -4q^2 - 22q + 12} \\
 \underline{-4q^2 - 2q} \\
 0 - 20q + 12 \\
 \underline{-20q - 10} \\
 22
 \end{array}$$

$$(-2q-10) + \frac{22}{2q+1}$$

Check: $((2q+1)(-2q-10)) + 22$

$$\begin{array}{r}
 (-4q^2 - 20q - 2q - 10) + 22 \\
 -4q^2 - 22q + 12 \checkmark
 \end{array}$$

21)

$$\begin{array}{r}
 2w^2 + 2w + 5 \\
 w-1 \overline{) 2w^3 + 0w^2 + 3w - 15} \\
 \underline{-2w^3 - 2w^2} \\
 2w^2 + 3w \\
 \underline{-2w^2 - 2w} \\
 5w - 15 \\
 \underline{-5w - 5} \\
 -10
 \end{array}$$

$$(2w^2 + 2w + 5) - \frac{10}{w-1}$$

Check: $((w-1)(2w^2+2w+5)) - 10$

$$\begin{array}{r}
 (w(2w^2+2w+5) - 1(2w^2+2w+5)) - 10 \\
 2w^3 + 2w^2 + 5w - 2w^2 - 2w - 5 - 10 \\
 2w^3 + 3w - 15 \checkmark
 \end{array}$$

*Need
Placeholders

23

$$\begin{array}{r}
 c^2 \\
 c-1 \overline{) c^3 - c^2 - 0c - 1} \\
 \underline{-c^3 - c^2} \\
 0 - 0c - 1 \\
 \text{or} \\
 -1
 \end{array}$$

$$c^2 - \frac{1}{c-1}$$

check: $((c-1)(c^2)) - 1$
 $c^3 - c^2 - 1 \checkmark$

25

$$A = \frac{1}{2}bh$$

$$2c^3 + 16 = \frac{1}{2}(c+2)(h)$$

OR

$$(2c^3 + 16 = \frac{(c+2)(h)}{2}) \cdot 2$$

$$\frac{4c^3 + 32}{c+2} = (c+2)(h)$$

$$\frac{4c^3 + 32}{c+2} = h$$

$$\begin{array}{r}
 4c^2 - 8c + 16 \\
 c+2 \overline{) 4c^3 + 0c^2 + 0c + 32} \\
 \underline{-4c^3 + 8c^2} \\
 -8c^2 + 0c \\
 \underline{-8c^2 + 16c} \\
 16c + 32 \\
 \underline{16c + 32} \\
 0
 \end{array}$$

Answer = $4c^2 - 8c + 16$

$$\begin{array}{r}
 27) \quad 4a+7 \overline{) 4a^2+3a-6} \\
 \underline{-4a^2+7a} \\
 -4a-6 \\
 \underline{-(-4a-7)} \\
 1
 \end{array}$$

$$a-1 + \frac{1}{4a+7}$$

* Need to write in standard form

$$\begin{aligned}
 \text{Check: } & (4a+7)(a-1) + 1 \\
 & (4a^2+7a-4a-7) + 1 \\
 & 4a^2+3a-6 \checkmark
 \end{aligned}$$

$$\begin{array}{r}
 29) \quad 2t-6 \overline{) 2t^2+4t-9} \\
 \underline{-2t^2-6t} \\
 10t-9 \\
 \underline{-10t-30} \\
 21
 \end{array}$$

$$t+5 + \frac{21}{2t-6}$$

$$\begin{aligned}
 \text{Check: } & (2t-6)(t+5) + 21 \\
 & (2t^2-6t+10t-30) + 21 \\
 & 2t^2+4t-9 \checkmark
 \end{aligned}$$

$$\begin{array}{r}
 33) \quad 3c-4 \overline{) 12c^3 + 11c^2 - 15c + 8} \\
 \underline{- 12c^3 - 16c^2} \\
 27c^2 - 15c \\
 \underline{- 27c^2 - 36c} \\
 21c + 8 \\
 \underline{- 21c - 28} \\
 36
 \end{array}$$

$$\textcircled{4c^2 + 9c + 7 + \frac{36}{3c-4}}$$

$$((4c^2 + 9c + 7)(3c - 4)) + 36$$

$$(3c(4c^2 + 9c + 7) - 4(4c^2 + 9c + 7)) + 36$$

$$12c^3 + 27c^2 + 21c - 16c^2 - 36c - 28 + 36$$

$$12c^3 + 11c^2 - 15c + 8 \quad \checkmark$$

1. $2x + 3y = 12$

2. $x - y = 4$

$$2x + 3y = 12$$

$$x - y = 4$$

$$2x + 3y = 12 \quad (1)$$

$$x - y = 4 \quad (2)$$

$$2x + 3y = 12 \quad (1)$$

$$x - y = 4 \quad (2)$$