Module 4: Introducing Polynomials

Section 4.1 Scientific Notation and Large Numbers

Practice Problems 4.1

For Problem 1-4, follow the instructions given to solve the problem.

1. Identify the numbers that are in scientific notation.

a) 4.6304×10^8 b) 22.7×10^3

c) $14{,}236$ d) 2.1×13^{10}

e) 6.5×10^{15} f) 2.003×10^5

2. List which letters in Problem 1 are numbers not written in scientific notation and tell why they are not.

3. Convert the standard notation numbers to scientific notation.

a) $50{,}464{,}000{,}000$ b) $22{,}000{,}000$

c) $6{,}310{,}000$ d) $204{,}000{,}000{,}000{,}000$

4. Convert each of the scientific notation numbers to standard form.

a) 6.52×10^7 b) 1.63×10^9

c) 4.096×10^{10} d) 7×10^6

For Problem 5-9, use the given information and table to solve the problem.

To the right is a list of the mass of the planets. If you look up the mass of planets online you will see "$3.30e23$" for Mercury. This "e" means exponent and the base is our common base system of 10. This is the same notation a scientific calculator uses. Therefore, $3.30e23$ means 3.30×10^{23}. The zero after the second 3 is unnecessary but all the planets are listed out to the hundredths place.

Planet	**Mass (kg)**
Mercury	$3.3e23$
Venus	$4.87e24$
Earth	$5.97e24$
Mars	$6.42e29$
Jupiter	$1.90e27$
Saturn	$5.68e26$
Uranus	$8.68e25$
Neptune	$1.02e26$
Pluto	$1.27e22$

5. Write the planets in order from least to greatest mass.

6. Which planet has the least mass?

7. Which planet has the greatest mass?

8. Write the planets in order from greatest to least mass.

9. The mass of the sun is 1.99×10^{30} kg. How does the mass of the sun compare to the mass of the planets. Does the sun have more or less mass than the planets? How do you know?

For Problem 10, use the given information to solve the problem. Answer the questions and write your solutions in scientific notation.

Approximately 2,000,000 red blood cells die in the average adult every second.

10. a) How many red blood cells die in the average adult every minute?

b) How many red blood cells die in the average adult every hour?

c) How many red blood cells die in the average adult every day?

For Problem 11-19, find the volume of the planet given its radius and write your solution in scientific notation to the hundredths place. The volume of a sphere is $V = \frac{4}{3}\pi r^3$.

	Planet	**Radius (km)**	**Volume ($\mathbf{km^3}$)**
11.	Mercury	2,440	
12.	Venus	6,052	
13.	Earth	6,378	
14.	Mars	3,397	
15.	Jupiter	71,492	
16.	Saturn	60,268	
17.	Uranus	25,559	
18.	Neptune	24,766	
19.	Pluto	1,150	

20. The sun has a radius of 695,000 km. What is the volume of the sun in scientific notation?

Section 4.2 Scientific Notation and Small Numbers

Practice Problems 4.2

For Problem 1-7, follow the instructions given to solve the problem.

1. Which of the following are not correct?

a) $1.62 \times 10^4 = 16{,}200$ b) $6.97 \times 10^{-5} = 0.0000697$

c) $3.06 \times 10^3 = 3{,}060$ d) $4.19 \times 10^{-8} = 0.00000419$

Explain why.

2. Which of the following is equivalent to 5.92×10^{-7}?

a) $592{,}000$ b) 0.0000592

c) $5{,}920{,}000{,}000$ d) 0.000000592

3. The diameter of human hair is 0.001 inches. Write this number in scientific notation.

4. The diameter of human hair is 0.00254 centimeters. Write this number in scientific notation.

5. The blonde hair is the finest, ranging from $\frac{1}{1{,}500}$ to $\frac{1}{500}$ of an inch in diameter. Black hair is the coarsest, ranging from $\frac{1}{450}$ to $\frac{1}{140}$ of an inch. Write these numbers using scientific notation. First convert them to decimals; they are easier to visualize in decimal form and then they can be converted scientific notation.

6. God has designed an amazing brain.

a) The brain makes up only 2% of a person's weight. If an adult weighs 204 pounds, how much does his brain weigh?

b) The brain uses 20% of an adult person's blood supply. The blood volume of an average adult is about 5 liters. How many liters of blood are supplied to the brain?

c) If 1 liter is equal to 1.05669 quarts, then how many quarts of the body's blood supply is used by the brain?

7. Neptune has a mass of 1.02×10^{26}. Pluto has a mass of 1.27×10^{22}. How many more zeroes does Pluto have than Neptune?

For Problem 8-15, use the signs $>$, $<$, or $=$ to solve the problem. (Notice that not all the numbers in exponential notation are in scientific notation.)

8. 1.02×10^3 ◯ 1.22×10^3

9. 4.57×10^2 ◯ 8.9×10^2

10. 3.82×10^{16} ◯ 382×10^{14}

11. 0.3×10^{-5} ◯ 1.5×10^{-3}

12. 300×10 ◯ 3.0×10^3

13. 7.77×10^{-4} ◯ 6.2×10^{-5}

14. 7.2×10^3 ◯ 7.3×10^{-3}

15. 0.003×10^4 ◯ 3.44×10^{-1}

For Problem 16-20, solve the word problem given.

16. Is $\frac{4.2}{10^{-2}}$ the same as 4.2×10^2?

17. Is 4.2×10^5 the same as $\frac{4.2}{10^5}$?

18. How many numbers come after the “2” in 2.874×10^8 when it is written in standard notation?

19. How many zeroes come after the decimal point in 2.874×10^8 when it is written in standard notation?

20. What is another way to write 28.16×10^4?

Section 4.3 Multiplying and Dividing Scientific Notation Numbers

Practice Problems 4.3

For Problem 1-13, multiply or divide the number in scientific notation.

1. $(3 \times 10^4)(4.1 \times 10^{-6})$

2. $(5.3 \times 10^2)(3.06 \times 10^8)$

3. $\frac{5.3\times10^4}{1.3\times10^4}$

4. $\frac{4.2}{2.1} \times 10^3$

5. $3.557 \times \frac{10^5}{10^7}$

6. $(5.1)(3.1 \times 10^5)$

7. $\frac{777\times10^5}{7.77\times10^4}$

8. $(2 \times 10^{-1})(3 \times 10^{-3})$

9. $\frac{2.8\times10^3}{1.4\times10^2}$

10. $\frac{4.2\times10^8}{6\times10^6}$

11. $\frac{4.2\times10^4}{7\times10^7}$

12. $\frac{10\times10^5}{10\times10^{-3}}$

13. $(3 \times 10^{-8})(3.2 \times 10^8)$

For Problem 14-20, solve the word problem given.

14. If an average 160-pound person has 5 liters of blood and 1 liter is equal to 1,000,000 microliters (μL), then how many microliters (μL) are in 5 liters? (Blood is usually measured in microliters. The symbol is μL). Write the number in scientific notation.

15. If there are 5-million red blood cells in every microliter of human blood (men actually tend to have more than women), how many red blood cells does the average adult have? Write the number using scientific notation.

16. A human body has about 3.2×10^4 μL (microliters) of blood for each pound of weight. About how many red blood cells does a 130-pound person have?

17. A 63-CD-R has about 550 megabytes (MB) of information. That is 5.5×10^8 bytes. One byte takes up about 3.5 mm of space. How many millimeters of space are on the 63-CD-R?

18. A millimeter is equal to $\frac{1}{1,000}$ of a meter. A micrometer (μm), usually used to represent storage space, is equal to $\frac{1}{1,000,000}$ of a meter. How many micrometers are in the storage space for the 63-CD-R from Problem 17?

19. Mole is a word used in chemistry to refer to amounts of substance. There are 6.02×10^{23} atoms in one mole of any given substance. This constant is referred to as Avogadro's number in honor of the scientist Amedeo Avogadro. If 16 grams of oxygen contain 6.02×10^{23} atoms (Avogadro's number), what is the mass of a single gram of oxygen?

20. If the mass of a single hydrogen atom is 1.67×10^{-24} grams, what is the mass of 1 mole of hydrogen atoms?

Section 4.4 Finding the Greatest Monomial Factor

Practice Problems 4.4

For Problem 1-4, find the GMF of the pair of monomials given.

1. $11m^2n^2$ and $33mn^2$

2. $14s^2t^3$ and $49s^3t^2$

3. x^2y^2z and $35x^2y$

4. $5pq$ and $10p^2q^2$

For Problem 5-10, follow the instructions to solve the problem given.

5. If $3x$ is one factor of $27xy$, find the other factor of $27xy$.

6. Multiply the two factors in Problem 5 together and see if they equal $27xy$.

7. Find two factors of $20pr^2$.

8. Show that the two factors in Problem 7 really are factors of $20pr^2$.

9. Find one other factor of $20pr^2$.

10. Demonstrate that the factor in Problem 9 is a factor of $20pr^2$.

For Problem 11 and 12, list the prime factorization of the monomial given and multiply all the prime factors to check and see if it gives you the original monomial.

11. $45m^3n^2o$

12. $51xy^2z^3$

13. What is $\frac{45np}{5n}$?

14. What is $(9p)(5n)$?

15. What is $\frac{27x^2y}{3x}$?

16. What is $(9xy)(3x)$?

For Problem 17-20, fill in the blank.

17. $\frac{50xyz}{\_\_\_\_\_\_} = 25x$

18. $\frac{-22mn}{\_\_\_\_\_\_} = -11$

19. $\_\_\_\_\_\_ \cdot (-2mn) = 14m^2n^2$

20. $-3x^3y \cdot \_\_\_\_\_\_ = -21x^3y^3$

Section 4.5 Using Operations with Monomials

Practice Problems 4.5

For Problem 1-8, name the degree of the monomial given.

1. $5y$

2. $7d^4$

3. -15

4. $6uv^5$

5. $-1.2abc$

6. mn^2

7. $-2x^2y^3z^4$

8. $-4ab^2c$

For Problem 9 and 10, solve the multiple-choice problem.

9. Which of the expressions are binomials?

a) $6xy^2z$ b) $4 + 2ab$ c) $(4ab)(-2)$

d) $15xy - 5.4$ e) $\frac{-14x}{3y}$ f) $w^2 - 2 + 5.6$

10. Which expressions in Problem 9 are monomials?

For Problem 11-16, simplify the expression given.

11. $(5n^2 + 6) + (2p^2 + 13)$

12. $(15p^2 + 2) + (3p^2 - 2)$

13. $22(q^2 + 16)$

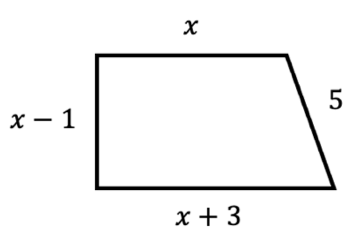
14. $(4mn + 1) - (3mn + 1)$

15. $-6(m^2n + m)$

16. $15(4 + 3x)$

For Problem 17-20, find the perimeter of the shape given. The perimeter is the distance around the outside of the figure.

17.



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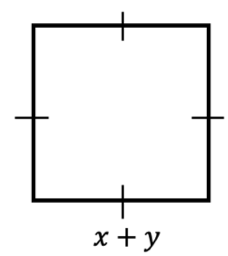

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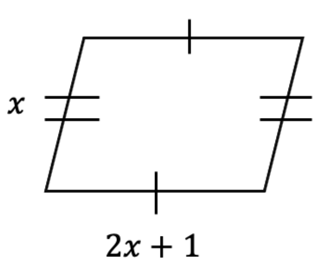

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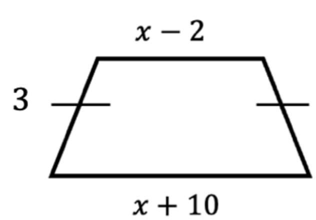


Section 4.6 Factoring Binomials Using the Greatest Monomial Factor

Practice Problems 4.6

For Problem 1-4, simplify the products given (they are monomials being multiplied by binomials).

1. $-2b(b-1)$

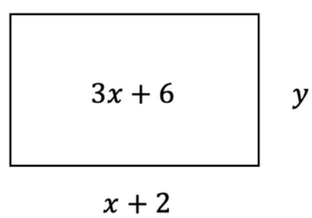
2. $6m(m+6)$

3. $2k(4k-5)$

4. $(x+3)4$

For Problem 5-8, solve the word problem given.

5. The rectangle shown below has an area of $3x+6$. Its side length is $x+2$. Find the width (y).

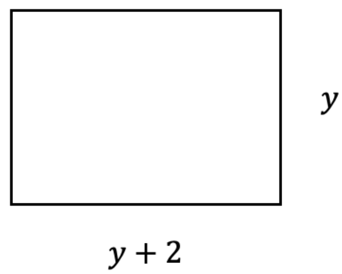


6. Factor n^2-n.

7. Is n^2-n in Problem 6 always even or always odd?

8. Find the perimeter of a rectangle in terms of y given its width is y and its length is 2 units longer than the width.

The perimeter is the distance around the outside of the rectangle.



For Problem 9-18, factor the binomial given.

9. $3x - 6$

10. $10 + 2y$

11. $5t^3 + 20t^2$

12. $3xy + 6x^2y^2$

13. $5x - 10xy^2$

14. $-14mn + 7xy$

15. $2abc^2 - 2ab^2c$

16. $3mn + 3m + 3n$

17. $4m^2n - 8mn^2 + 2mn$

18. $12x^3y^2 - 4xy$

For Problem 19 and 20, solve the word problem given.

19. David said that $-3x(5x-3)$ is equal to $-15x^2+9x$. Jeff said that $-3x(5x-3)$ is equal to $-15x-6x$. Bart said that $-3x(5x-3)$ is equal to $15x+9x$. Who is correct? What mistakes were made on the two that were incorrect?

20. If the Greatest Common Factor of m and n is 3, what is the GCF of m^2 and n^2?

Section 4.7 Multiplying a Monomial and a Trinomial

Practice Problems 4.7

For Problem 1-10, use the distributive property to multiply the terms given.

1. $-3x(x-4)$

2. $(x+4)6$

3. $(m-2)(-1.2)$

4. $4x^2(x+12)$

5. $n(n^3+2n^2+5)$

6. $-2(m+m^2)$

7. $\frac{1}{4}(2x-8)$

8. $-\frac{1}{3}(2n+3)$

9. $3xy(2x-y)$

10. $(-3x+4)\frac{3}{8}$

For Problem 11-18, use long multiplication to multiply the terms given.

11. $(5 + x)(-2)$

12. $(m^3 + m^2 + m)m$

13. $-4(x^2 + 2x + 9)$

14. $-2(x + xy + y)$

15. $(m^2 + 3m)2m$

16. $(x^2 + 2x + y)(-10)$

17. $6(-3n^2 + 9n - 2)$

18. $3x(3x^2 + 2x - 1)$

For Problem 19 and 20, solve the word problem given.

19. The volume of a rectangular prism has a length of 1.5×10^{-4} km, a width of 1.3×10^{-4} km, and a height of 1.7×10^{-5} km. What is the volume of the rectangular prism written in scientific notation? What is the volume of the rectangular prism when it is converted to cubic meters? (Note: $1 \text{ km} = 1{,}000 \text{ m}$ and $1 \text{ km}^3 = 1{,}000{,}000{,}000 \text{ m}^3$)

20. Write m^6 as a product of two powers in three different ways. Use a negative and zero exponent for two of them. How many ways can this be written as a product of two powers?

Section 4.8 Multiplying Two Binomials Using the Distributive Property

Practice Problems 4.8

For Problem 1 and 2, follow the instructions given to solve the problem.

1. Multiply the two binomials using the distributive property.

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

2. Tell why you did not get a trinomial for a solution in Problem 1.

For Problem 3-8, multiply the binomials given using the distributive property.

3. $(m+6)(m-2)$

4. $(y-8)(y-4)$

5. $(3n+4)(2n+1)$

6. $(4n-2)(n+7)$

7. $(4x^3-1)(x+2)$

8. $(-2x^2+1)(x-4)$

For Problem 9-11, solve the word problem given.

9. How is Problem 7 different than Problem 3-6?

10. Multiply the binomial and trinomial using the distributive property:

$$(x+2)(x^2+2x+1)$$

11. How many terms do you get for a solution in Problem 10 and why?

For Problem 12-17, multiply the polynomial given using the distributive property.

12. $y(2y-5)$

13. $(5x-3)x$

14. $(x-2)(x+2)$

15. $(x+2)(x+2)$

16. $(x - 2)(x - 2)$

17. $(y - 3)(y - 4)$

For Problem 18-20, solve the word problem given.

18. What do you think you will get when you multiply $(x + 3)$ by $(x - 3)$?

19. What do you think you will get when you multiply $(x + 3)$ by $(x + 3)$?

20. What do you think you will get when you multiply $(x - 3)$ by $(x - 3)$?

Section 4.9 Multiplying Two Binomials Using Geometric Models

Practice Problems 4.9

For Problem 1-6, draw a rectangle diagram for the binomials and label the area of the inner rectangle.

1. $(x+5)(x+3)$

2. $(y+6)^2$
(This can be written: "$(y+6)(y+6)$")

3. $(x-2)(x+4)$

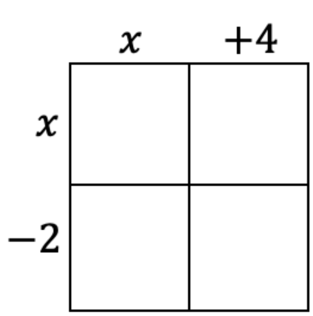
4. $(y-2)^2$

5. $(2m+3)(2m-1)$

6. $(m-1)(m-2)$

For Problem 7-12, label the inner area of the rectangle diagram given that represents the binomials. Find the sum for the total area by combining like (common) terms.

7.



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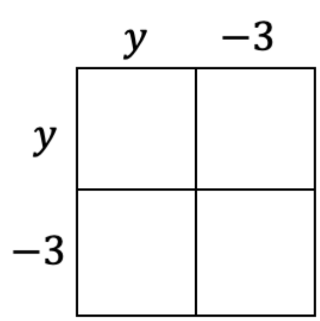


9.

	m	$+2$
m		
-2		

10.

	n	$+4$
n		
$+4$		

11.

	t	$+7$
t		
-1		

12.

	n	$+4$
m		
-2		

For Problem 13-21, find the missing values (?) in the rectangular diagrams given and express the total area as a trinomial.

13.

	?	?
x	?	$-4x$
$+1$	x	?

14.

	x	?
x	?	?
$+4$	?	8

15.

	?	?
?	x^2	$2x$
?	$2x$	4

16.

	x	-1
x	?	?
-3	?	?

17.

	x	3
?	?	$3x$
?	$2x$	?

18.

	x	-2
?	?	$-2x$
?	$-3x$	?

19.

	?	$+3$
?	?	?
?	$-5x$	-15

20.

	x	-4
?	x^2	$-4x$
?	x	?

Section 4.10 Multiplying Two Binomials Using Long Multiplication

Practice Problems 4.10

For Problem 1-5, solve the word problem given.

1. Find the missing numbers in the rectangular diagram (geometric model) below.

	?	?
x	x^2	$-2x$
?	?	4

2. What is the area of the rectangular diagram (geometric model) in Problem 1?

3. What are the length and width of the rectangular diagram (geometric model) in Problem 1?

4. Multiply the length and width of the rectangular diagram (geometric model) using long-multiplication. Why should you get the same solution as in Problem 2?

5. Check your solution to Problem 4 using the distributive property to multiply length and width.

For Problem 6-15, use long multiplication to multiply the binomials given.

6. $(m + 2.1)(m + 3.2)$

7. $(n - 6)(n + 2)$

8. $(x + 3)^2$

9. $(x - 3)^2$

10. $(x + 1)(x - 1)$

11. $(t + 4)(t - 2)$

12. $(m+1)(m+1)$

13. $(x-10)(x+2)$

14. $(n-3)(n-2)$

15. $(y+1)(y-7)$

For Problem 16-20, solve the word problem given.

16. Use long multiplication to multiply $(x+3)$ by $(x+1)$.

17. Use the distributive property to multiply $(x+3)$ by $(x+1)$.

18. Use an array (the geometric model) to multiply $(x + 3)$ by $(x + 1)$.

19. How would changing the signs of 3 and 1 to their opposite change your solution to Problem 18?

20. Why does the sign of the middle term change to its opposite, but the sign of the last term stays the same in Problem 19?

Section 4.11 Introducing Polynomials

Practice Problems 4.11

For Problem 1-5, name the degree of the polynomial given after writing it in standard form. Then name the polynomial by the number of terms in it.

1. $-3x + 5x^2 - 8$
2. $13m^5 + 10m^6 - 1.8$
3. $xy^2 + 3x^2y$
4. $-16 + x^3y^2$
5. $3 - 2x + 4x^3$

For Problem 6-10, write the polynomial given in standard form and underline the lead coefficient.

6. $3x - 4 + 2x^2 + 5x^3$
7. $m + 2m^2 + 3m^3$
8. $-6 + 9x^2 - x$
9. $2x - 3 + 5x^2 - 7x^3$
10. $4x^2 - 4x^3 + 5x^4$

For Problem 11-14, add or subtract the binomial given.

11. $(3x^2 + 2x) + (5x^2 - 8)$
12. $(5x^2 + x) - (5x^2 - x)$

13. $(13x^4 + 3x^3) - (9x^4 - 3x^3)$

14. $(3x^3 + x) + (3x^2 + x)$

For Problem 15-18, add or subtract the trinomials.

15. $(-16x^2 + 10x + 2) - (24x^2 - 5x + 6)$

16. $(15 + 22x + 17x^2 + (14x + 6 - 10x^2)$

17. $(2x^2 - 3x + 2) - (-4x^2 - 2x + 5)$

18. $(x^3 + 2x + 3) + (4x^2 + 9)$

For Problem 19 and 20, solve the word problem given.

19. Can you add a binomial to a trinomial, or do they have to have the same number of terms to be added?

20. If you add a binomial to a trinomial, will you always, sometimes, or never get a binomial?

<u>Section 4.12 Multiplying Polynomials</u>

<u>Practice Problems 4.12</u>

For Problem 1-10, follow the instructions given to solve the problem.

1. Fill in the missing terms using the distributive property:

$$(m^2 + 2m + 1)(3m^2 + 4m + 6)$$

a) $m^2(3m^2) + m^2(4m) + m^2(\underline{\qquad\qquad}) + 2m(3m^2) + 2m(\underline{\qquad\qquad}) + 2m(6) +$

$1(\underline{\qquad\qquad}) + 1(4m) + 1(6)$

b) $3m^4 + \underline{\qquad\qquad} + 6m^2 + 6m^3 + \underline{\qquad\qquad} + 12m + 3m^2 + 4m + \underline{\qquad\qquad}$

c) $3m^4 + (4m^3 + 6m^3) + (6m^2 + 8m^2 + \underline{\qquad\qquad}) + (12m + \underline{\qquad\qquad}) + 6$

d) $3m^4 + \underline{\qquad\qquad}m^3 + 17m^2 + \underline{\qquad\qquad}m + 6$

2. Fill in the missing terms in the geometric model.

	$3m^2$	$4m$	6
m^2			
$2m$			
1			

3. What is the area of the rectangular diagram in Problem 2? Is this the same solution you got in Problem 1?

4. What is the degree of the polynomial in Problem 3?

5. What is the lead coefficient in Problem 3?

6. Multiply $(n + 1)$ by $(n^2 + n + 1)$ using long multiplication.

7. Multiply $(x + 1)$ by $(x^2 + 2x - 1)$ using the distributive property.

8. Multiply $(y + 2)$ by $(y^2 - 2y + 7)$ using the geometric model.

9. Multiply $(m - 3)$ by $(m^2 + 3m - 4)$ using long multiplication.

10. Multiply $(x + 1)$ by $(x^2 - 2x + 4)$ using any method.

Section 4.13 Factoring Trinomials Using the Greatest Monomial Factor

Practice Problems 4.13

For Problem 1-6, follow the instructions given to solve the problem.

1. Example 1 in the Looking Ahead 4.13 section factored to $3x(x^2+3x+9)$. Use a rectangular diagram to show that it is equal to $3x^3+9x^2+27x$.

2. Example 2 in the Looking Ahead 4.13 section factored to $2(m^2-2m+3)$. Use long multiplication to show that it is equal to $2m^2-4m+6$.

3. What is the GMF of $3x^3-x^2+7x$?

4. Divide the GMF that is one factor of $3x^3-x^2+7x$ to find the other factor.

5. Multiply the two factors in Problem 4 using the distributive property to show that their product is $3x^3-x^2+7x$.

6. Find the GMF of $7x^2 - 7x + 7$. Factor the trinomial using the GMF.

For Problem 7-14, find the GMF of the trinomial given.

7. $2x^3 + 4x^2 + 8$

8. $3m^3 - 3m^2 + 3m$

9. $24x^3y^2 - 12x^2y^2 + 6xy$

10. $2x^3 - 5x^2 + 4x$

11. $5mn - 10m + 15n$

12. $2x^3 + 3y^3$

13. $x^2y - xy^2$

14. $-20x^2y - 10xy^2 + 5xy$

For Problem 15-20, factor the trinomial given if possible.

15. $-3x^3 - 9x^2 + 6x$

16. $3x^2 - 4y^2 + 5xy$

17. $7x^3y^3 - 14x^2y^2 + 7xy$

18. $22x^2y^2 - 11xy^2 + 4x^2y$

19. $-13m^2n^2 + 26mn$

20. $15x^4 - 21x^2 + 39x$

Section 4.14 Module Review

For Problem 1 and 2, convert the number given to scientific notation.

1. 53,241,000

2. 0.000642

For Problem 3-5, follow the instructions given to solve the problem.

3. The US population in 2012 was 312,780,968 people (approximately 312.8 million). Approximately 2,600,000,000,000 trillion ($2.6 trillion) was spent on annual public and private healthcare. Tell approximately how much money was spent per individual on healthcare in 2012.

4. The population of the top ten populated countries in 2012 are listed below. Put them in order from least to greatest.

Country	**Approximate Population (2012)**
India	1.205×10^9
Japan	1.273×10^8
United States	3.138×10^8
Russia	1.425×10^8
Pakistan	1.9×10^8
Nigeria	1.7×10^8
Bangladesh	1.61×10^8
Brazil	1.93×10^8
China	1.34×10^9
Indonesia	2.48×10^8

5. The light that can be seen is called "visible light:" visible light is from 380 nm to 740 nm (1 nm $= 1 \times 10^{-9}$ m). Sunburn occurs at 1×10^{-7} m. Tell whether the light that penetrates the skin and causes sunburn is visible light (1 nanometer $= 1.0 \times 10^{-9}$ meter).

For Problem 6-9, simplify the polynomial given.

6. $5x^2 - 4.2x + 3.6x - 7.4y$

7. $2(3x + 4) + 6(9x - 5)$

8. $(3x^3 + 19x^2) - (10x^3 - 10x^2)$

9. $(b^2 + 2b + 3) + (4b^2 - b - 16)$

For Problem 10-13, combine like terms and write the polynomial in standard form. Name the polynomial based on the number of terms in it.

10. $-8q + 5q^3 - 2q + 3q^2$

11. $m^8 + m - 3m^4 - 2m$

12. $2.2x - 5.1x^2$

13. $3t - 8 + 5t^2$

For Problem 14-18, use the distributive property to simplify the polynomial given. Name the degree of the polynomial and underline the lead coefficient.

14. $8n(n - 2)$

15. $(x - 6)3x$

16. $-3c^3(12c^2 - 8c + 7)$

17. $(2x + 4)(3x - 2)$

18. $t^2(t + 2) + 3t(t^2 - 5)$

For Problem 19-22, follow the instructions given to solve the problem.

19. Tell what you get when you divide the first term, second term, and third term in $9z^3 + 3z^2 - 12z$ by the GMF $3z$.

$\frac{9z^3}{3z} =$ $\frac{3z^2}{3z} =$ $-\frac{12z}{3z} =$

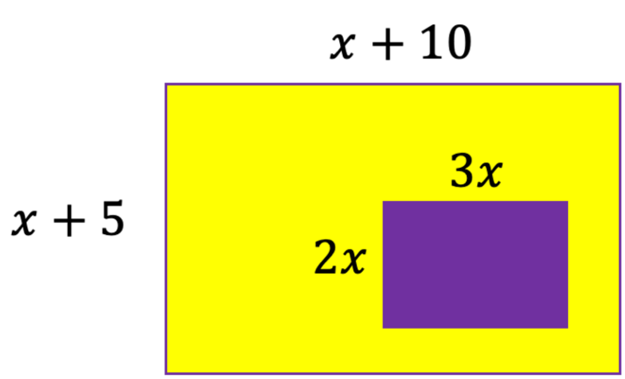
20. The polynomial $9z^3 + 3z^2 - 12z$ has been factored. The GMF is $3z$. Complete the missing parts of the factored expression below.

$$9z^3 + 3z^2 - 12z$$

$$3z(\_\_\_\_\_\_\_\_\_\_\_ z^2 + \_\_\_\_\_\_\_\_\_\_\_ - 4)$$

21. Multiply the monomial by the trinomial in the factored form of $9z^3 + 3z^2 - 12z$. Did you get the trinomial for the product?

22. Find the area of the lightly shaded yellow region in the shape below.
(Hint: Area of Large Rectangle (Yellow and Purple) − Area of Small Rectangle (Purple)
` = Area of Lightly Shaded Yellow Region)



Section 4.15 Module Test

For Problem 1 and 2, convert the number given to scientific notation.

1. $409{,}600{,}000$

2. 0.000007103

For Problem 3-5, follow the instructions given to solve the problem.

3. If a computer performs 5.76×10^9 commands per second, tell how many commands it can perform per minute.

4. Measuring tools have differing degrees of precision. The first tool is precise to 4.3×10^{-2} mm, the second tool is precise to 8.3×10^{-4} mm, and the third tool is precise to 1×10^{-3} mm. Order these tools from greatest to least by precision. Which tool would you choose if your measurements need to be extremely precise?

5. Visible light to the eye is between 3.8×10^{-7} meters and 7.4×10^{-7} meters. Ultraviolet rays (UV rays) that penetrate the skin and cause sunburn are 1×10^{-7} meters.

a) These UV rays are 1,000 times the wavelength of electromagnetic x-rays that penetrate the skin but do not cause sunburn. How long are the wavelengths of x-rays?

b) Are x-ray wavelengths shorter or longer than wavelengths of ultraviolet rays that cause sunburn?

c) Are x-ray wavelengths visible?

For Problem 6-9, simplify the polynomial given.

6. $(2x + 5y) - (3x - 2y)$

7. $(9m - 3n) + (12m - 2n)$

8. $(7y^4 - 3y^3 + 2y) + (9y^4 - 6y)$

9. $2(q^2 - 4) + 7(q^2 - 1)$

For Problem 10-13, complete the table given to solve the problem.

	Polynomial	**Degree**	**Name by Number of Terms**
10.	$4x^2 - 3x + 2$	2	
11.	$10x^8 - 3$		Binomial
12.	$5.6xy$		

13. What is the lead coefficient in Problem 11?

For Problem 14-16, use the distributive property to simplify the polynomial. Put the polynomial in standard form and underline the lead coefficient.

14. $-22x^2(3 + x)$

15. $6x^6(-10^3 + 3x^2 - 4)$

16. $(m + 8)(m - 2)$

17. $(k + 3)18k$

18. $-3g(g + 8) + 2g(4)$

For Problem 19-21, factor the polynomial given.

19. $-14p^2 + p^3$

20. $15w^3 - 5w^2 + 10$

21. $2m^5 - 10m^4 + 20m^3$

22. Find the area of the lightly shaded yellow region in the shape below.
(Hint: Area of Large Rectangle (Yellow and Purple) $-$ Area of Small Rectangle(Yellow) $=$ Area of Lightly Shaded Yellow Region)