

Mukilteo School District

Sixth Grade Advanced
Mathematics

Review \& Practice

Dear families,

As our community works to understand and respond to the effects of COVID-19, the Mukilteo School District sincerely appreciates your patience as we navigate this period of unprecedented school closures.

Attached to this letter is a packet of materials to help you supplement your child's education while away from the formal school environment. Please feel free to use the grade-level packets to review and practice previously taught skills in English/Language Arts, Mathematics and Science. They are not required, nor will they be graded. Answer keys are included in the packets so that your child can check their own work. Students are encouraged to skip around and find topics of interest and practice rather than complete them from beginning to end. If you find that your child's grade level is too challenging, or not challenging enough, you are welcome to work outside of their current grade level.

It is highly encouraged that your child continues to review and practice previously taught skills and remain engaged in learning. We hope these packets add to what you are already doing to support your child in learning during this challenging time.

Sincerely,

The Curriculum and Instruction Department
Mukilteo School District
$\qquad$
Key Concept and Vocabulary


$4^{1}=4$


## Application Example

6. How many small cubes are in the stack?

$$
\begin{aligned}
3^{3} & =3 \cdot 3 \cdot 3 \\
& =27
\end{aligned}
$$


$\therefore 27$ small cubes are in the stack.
5. $9^{5}=9 \cdot 9 \cdot 9 \cdot 9 \cdot 9=59,049$

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$

Find the value.
7. $3^{4}=$ $\qquad$
8. $4^{5}=$ $\qquad$
9. $12^{3}=$ $\qquad$ 10. $18^{1}=$ $\qquad$
11. $5^{6}=$ $\qquad$ 12. $2^{10}=$ $\qquad$ 13. $8^{2}=$ $\qquad$ 14. $7^{3}=$ $\qquad$

## Use an exponent to rewrite the expression.

15. $4 \cdot 4 \cdot 4 \cdot 4=$ $\qquad$ 16. $1 \cdot 1 \cdot 1=$ $\qquad$
16. $5 \cdot 5 \cdot 5=$ $\qquad$ 18. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3=$ $\qquad$
How many small cubes are in the stack?
17. 


$\qquad$
$\qquad$
$\qquad$
20.

$\qquad$
21. FLYING SAUCERS You saw 5 flying saucers. Each flying saucer had 5 aliens. Each alien had 5 eyes. How many alien eyes were there altogether? Explain your reasoning.
$\qquad$

## Key Concept and Vocabulary

## "Please Excuse My Dear Aunt Sally"

Simplify $4^{2} \div 2+3(9-5)$.
1st Parentheses
2nd Exponents
3rd Multiplication and Division (from left to right)
4th Addition and Subtraction (from left to right)

$$
\begin{aligned}
4^{2} \div 2+3(9-5) & =4^{2} \div 2+3 \cdot 4 \\
& =16 \div 2+3 \cdot 4 \\
& =8+12 \\
& =20
\end{aligned}
$$

## Application Example

6. At a museum, 4 adults pay $\$ 5$ each and 6 children pay $\$ 3$ each. What is the total cost of the tickets?

$$
\begin{align*}
4 \cdot 5+6 \cdot 3 & =20+18 \\
& =38
\end{align*}
$$

4. $20 \div 10+21 \cdot 5=2+105=107$
5. $(2+3)^{2}-5=25-5=20$

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$


$\because$ The total cost is $\$ 38$.

## Simplify.

7. $3^{2}+5(4-2)=$ $\qquad$
8. $3+4 \div 2=$ $\qquad$
9. $10 \div 5 \cdot 3=$ $\qquad$
10. $4\left(3^{3}-8\right) \div 2=$ $\qquad$
11. $3 \cdot 6-4 \div 2=$ $\qquad$
12. $12+7 \cdot 3-24=$ $\qquad$

Insert parentheses to make the statement true.
13. $5^{2}-15 \div 5=2$
14. $12 \cdot 2^{3}+4=144$
15. $91-21 \div 7=10$

## Write an expression for the total area of the two rectangles. Evaluate your expression.

16. 


$+$

17.

18. ADMISSION At a baseball game, 6 adults pay $\$ 20$ each and 4 children pay $\$ 10$ each. What is the total cost of the tickets? $\qquad$
19. INSERTING PARENTHESES Insert parentheses in the expression $4+2^{3}-5 \cdot 2$ in two ways: (a) so that the value is 10 and (b) so that the value is 14 .
(a) $\qquad$
(b) $\qquad$
$\qquad$

Key Concept and Vocabulary
The greatest common factor (GCF) of two or more positive monomials is the product of their common prime factors.
Prime factorization:
$165=3 \cdot 5 \cdot 11$
$210=2 \cdot 3 \cdot 5 \cdot 7$
The GCF of 165 and 210
is $3 \cdot 5=15$.


Visual Model


$$
\mathrm{GCF}=2 \cdot 3 \cdot 6
$$

## Skill Examples

1. $15=3 \cdot 5$
$30=2 \cdot 3 \cdot 5$
$\mathrm{GCF}=3 \cdot 5=15$
2. $20=2 \cdot 2 \cdot 5$
$28=2 \cdot 2 \cdot 7$
$\mathrm{GCF}=2 \cdot 2=4$
3. $48=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$
$90=2 \cdot 3 \cdot 3 \cdot 5$
$\mathrm{GCF}=2 \cdot 3=6$
4. $18 x^{3}=2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$
$21 x^{2}=3 \cdot 7 \cdot x \cdot x$
$\mathrm{GCF}=3 \cdot x \cdot x=3 x^{2}$

## PRACTICE makes PURR-FECT ${ }^{\text {Tm }}$

## Application Example

5. You have 48 red flowers, 60 yellow flowers, and 84 white flowers. You want to make flower arrangements that have the same number of each color. What is the greatest number of arrangements that you can make if every flower is used?

$$
\left.\begin{array}{l}
48=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \\
60=2 \cdot 2 \cdot 3 \cdot 5 \\
84=2 \cdot 2 \cdot 3 \cdot 7
\end{array}\right\} \quad \begin{aligned}
& \mathrm{GCF}=2 \cdot 2 \cdot 3 \\
&=12
\end{aligned}
$$

$\because \quad$ You can make 12 arrangements.

## Find the greatest common factor.

6. $36=$ $\qquad$ GCF $=$ $\qquad$ 7. $70=$ $\qquad$ GCF $=$ $\qquad$
$45=$ $\qquad$
7. $42=$ $\qquad$
$105=$ $\qquad$
GCF = $\qquad$
8. $27 y=$ $\qquad$
GCF = $\qquad$
$54 y^{3}=$ $\qquad$
9. CLOTH You have two pieces of cloth. One piece is 80 inches wide and the other is 96 inches wide. You want to cut both pieces into strips of equal width that are as wide as possible. How wide should you cut each strip? width $=$ $\qquad$
$\qquad$

## Multiple

## Key Concept and Vocabulary

The least common multiple (LCM) of two or more positive monomials is the product of their factors, using each common prime factor only once.
Prime factorization:
$30=2 \cdot 3 \cdot 5$
$42=2 \cdot 3 \cdot 7$
The LCM of 30 and 42 is
$2 \cdot 3 \cdot 5 \cdot 7=210$.


Visual Model


$$
\mathrm{LCM}=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5=720
$$

## Skill Examples

1. $15=3 \cdot 5$
$30=2 \cdot 3 \cdot 5$
$\mathrm{LCM}=2 \cdot 3 \cdot 5=30$
2. $20=2 \cdot 2 \cdot 5$
$28=2 \cdot 2 \cdot 7$
LCM $=2 \cdot 2 \cdot 5 \cdot 7=140$
3. $48=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$
$90=2 \cdot 3 \cdot 3 \cdot 5$
LCM $=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5=720$
4. $18 x^{3}=2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$
$21 x^{2}=3 \cdot 7 \cdot x \cdot x$
$\mathrm{LCM}=2 \cdot 3 \cdot 3 \cdot 7 \cdot x \cdot x \cdot x=126 x^{3}$

## Application Example

5. Hot dogs come in packages of 10 and hot dog buns come in packages of 8 . What is the least number of packages of each that you need to buy to have the same number of hot dogs and hot dog buns?

$$
\left.\begin{array}{l}
10=2 \cdot 5 \\
8=2 \cdot 2 \cdot 2
\end{array}\right\} \quad \begin{aligned}
\text { LCM } & =2 \cdot 2 \cdot 2 \cdot 5 \\
& =40
\end{aligned}
$$

$40 \div 10=4$ packages of hot dogs
$40 \div 8=5$ packages of hot dog buns
$\therefore \quad$ You must buy 4 packages of hot dogs and 5 packages of hot dog buns.

## PRACTICE makes PURR-FECT ${ }^{\text {TM }}$



Check your answers at BigIdeasMath.com.
Find the least common multiple.
6. $36=$ $\qquad$ LCM $=$ $\qquad$ 7. $70=$ $\qquad$ $\operatorname{LCM}=$ $\qquad$
$45=$ $\qquad$
8. $42=$ $\qquad$ LCM $=$ $\qquad$
$105=$ $\qquad$
10. $27 y=$ $\qquad$ $\operatorname{LCM}=$ $\qquad$ 11. $56 m^{5}=$ $\qquad$ LCM $=$ $\qquad$
$54 y^{3}=$ $\qquad$ $68 m^{4}=$ $\qquad$
12. BOXES Boxes that are 12 inches tall are being stacked next to boxes that are 18 inches tall. What is the shortest height at which the two stacks will be the same height? height = $\qquad$

REVIEW: Multiplying Fractions


Name $\qquad$

## Visual Model



## Skill Examples

1. $\frac{2}{3} \cdot \frac{1}{4}=\frac{2 \cdot 1}{3 \cdot 4}=\frac{2}{12}=\frac{1}{6}$
2. $\frac{3}{8} \times \frac{2}{9}=\frac{3 \cdot 2}{8 \cdot 9}=\frac{6}{72}=\frac{1}{12}$
3. $\left(\frac{2}{5}\right)\left(\frac{1}{4}\right)=\frac{2 \cdot 1}{5 \cdot 4}=\frac{2}{20}=\frac{1}{10}$
4. $\frac{1}{7} \cdot \frac{3}{5}=\frac{1 \cdot 3}{7 \cdot 5}=\frac{3}{35}$

## Application Example

5. A recipe calls for three-fourths cup of flour. You want to make one-half of the recipe.
How much flour should you use?

$$
\frac{1}{2} \cdot \frac{3}{4}=\frac{1 \cdot 3}{2 \cdot 4}=\frac{3}{8}
$$

$\therefore$ You should use $\frac{3}{8}$ cup flour.

## PRACTICE makes PURR-FECT ${ }^{\text {Tm }}$

Find the product. Write your answer in simplified form.
6. $\frac{1}{3} \cdot \frac{2}{7}=$ $\qquad$ 7. $\frac{1}{2} \times \frac{1}{4}=$ $\qquad$
8. $\frac{1}{10} \cdot \frac{3}{10}=$ $\qquad$
9. $\frac{3}{2} \times \frac{2}{5}=$
$\qquad$
10. $\frac{3}{8} \times \frac{1}{2}=$ $\qquad$
11. $\left(\frac{1}{5}\right)\left(\frac{2}{5}\right)=$ $\qquad$
12. $\left(\frac{2}{3}\right)^{2}=$ $\qquad$
13. $\frac{3}{2} \cdot \frac{2}{3}=$ $\qquad$
14. $\left(\frac{3}{1}\right)\left(\frac{1}{3}\right)=$ $\qquad$ 15. $2 \cdot \frac{1}{4}=$ $\qquad$ 16. $3 \times \frac{3}{4}=$ $\qquad$ 17. $\frac{1}{3} \cdot \frac{3}{4} \cdot \frac{4}{5}=$ $\qquad$

Find the area of the rectangle or parallelogram.
18.


Area $=$ $\qquad$
19.


Area $=$ $\qquad$
20.


Area $=$ $\qquad$
21.


Area $=$ $\qquad$
22. OPEN-ENDED Find three different pairs of fractions that have the same product.


REVIEW: Multiplying Mixed Numbers Name $\qquad$


## Skill Examples

1. $3 \frac{1}{2} \times 2 \frac{1}{3}=\frac{7}{2} \times \frac{7}{3}=\frac{49}{6}=8 \frac{1}{6}$
2. $1 \frac{3}{4} \cdot 4 \frac{1}{2}=\frac{7}{4} \cdot \frac{9}{2}=\frac{63}{8}=7 \frac{7}{8}$
3. $2 \frac{2}{5} \times 1 \frac{2}{3}=\frac{12}{5} \times \frac{5}{3}=\frac{60}{15}=4$
4. $\left(1 \frac{1}{2}\right)\left(1 \frac{1}{2}\right)=\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)=\frac{9}{4}=2 \frac{1}{4}$

## Visual Model



$$
\text { Area }=2 \frac{1}{2} \times 1 \frac{1}{2}=\frac{15}{4}=3 \frac{3}{4}
$$

## Application Example

5. Find the area of the triangle.

$$
\begin{aligned}
\text { Area } & =\frac{1}{2} \cdot 1 \frac{1}{2} \cdot 3 \\
& =\frac{1}{2} \cdot \frac{3}{2} \cdot \frac{3}{1}=\frac{9}{4}=2 \frac{1}{4}
\end{aligned}
$$



## PRACTICE makes PURR-FECT ${ }^{\text {me }}$

Find the product. Write your answer as a whole number or mixed number in simplified form.
6. $2 \frac{1}{3} \times 1 \frac{1}{3}=$ $\qquad$ 7. $4 \frac{2}{3} \times 1 \frac{1}{2}=$ $\qquad$
8. $1 \frac{1}{2} \times 3=$ $\qquad$
9. $5 \frac{1}{6} \times \frac{1}{3}=$ $\qquad$
10. $\frac{3}{4} \cdot 3 \frac{1}{2}=$ $\qquad$
11. $5 \cdot 4 \frac{1}{2}=$ $\qquad$
12. $2 \frac{1}{7} \cdot \frac{7}{15}=$ $\qquad$ 13. $1 \frac{3}{5} \cdot \frac{3}{8}=$ $\qquad$
14. $\left(1 \frac{1}{3}\right)^{2}=$ $\qquad$ 15. $\left(1 \frac{1}{4}\right)^{3}=$ $\qquad$ 16. $\left(2 \frac{1}{2}\right)\left(3 \frac{1}{3}\right)=$
17. $\left(3 \frac{1}{2}\right)\left(\frac{1}{2}\right)^{2}=$ $\qquad$

## Find the area of the triangle.

18. 


20. RECIPE Rewrite the recipe so that each item is one-third of the full recipe.

19.


Area $=$ $\qquad$
$\qquad$ cups flour
$\qquad$ tsp baking powder
$\qquad$ tsp salt
$\qquad$ cup milk
$\qquad$ Tbsp butter
$\qquad$


## Visual Model

There are 2 "one-thirds" in two-thirds.

$$
\frac{2}{3} \div \frac{1}{3}=\frac{2}{3} \cdot \frac{3}{1}=2
$$

| $\frac{1}{3}$ | $\frac{1}{3}$ |  |
| :---: | :---: | :--- |

## Skill Examples

1. $\frac{2}{5} \div \frac{1}{5}=\frac{2}{5} \cdot \frac{5}{1}=\frac{2 \cdot 5}{5 \cdot 1}=2$
2. $\frac{2}{5} \div 5=\frac{2}{5} \cdot \frac{1}{5}=\frac{2 \cdot 1}{5 \cdot 5}=\frac{2}{25}$
3. $\frac{9}{4} \div \frac{3}{4}=\frac{9}{4} \cdot \frac{4}{3}=\frac{9 \cdot 4}{4 \cdot 3}=3$

## Application Example

5. You drive 25 miles in one-half hour. What is your average rate?

$$
25 \div \frac{1}{2}=\frac{25}{1} \cdot \frac{2}{1}=50 \mathrm{mi} / \mathrm{h} \quad r=\frac{d}{t}
$$

$\therefore$ Your average rate is 50 miles per hour.
4. $6 \div \frac{1}{2}=\frac{6}{1} \cdot \frac{2}{1}=\frac{6 \cdot 2}{1 \cdot 1}=12$

## PRACTICE makes PURR-FECT ${ }^{\text {TM }}$

Find the quotient. Write your answer in simplified form.
6. $\frac{3}{5} \div \frac{1}{5}=$ $\qquad$
7. $4 \div \frac{1}{2}=$ $\qquad$
8. $\frac{2}{3} \div \frac{1}{6}=$ $\qquad$ 9. $\frac{1}{6} \div \frac{2}{3}=$ $\qquad$
10. $\frac{2}{3} \div 2=$ $\qquad$
11. $\frac{3}{4} \div 4=$ $\qquad$
12. $\frac{3}{7} \div \frac{3}{7}=$ $\qquad$
13. $\frac{3}{7} \div \frac{7}{3}=$
$\qquad$
14. $5 \div \frac{1}{2}=$ $\qquad$
15. $\frac{9}{4} \div \frac{1}{4}=$ $\qquad$
16. $\frac{1}{4} \div \frac{1}{2}=$ $\qquad$
17. $\frac{3}{11} \div 11=$ $\qquad$

Find the height of the rectangle or parallelogram.
18.


Area $=\frac{1}{4} \mathrm{ft}^{2}$
19.


Area $=\frac{2}{25} \mathrm{~cm}^{2}$
20.


Area $=\frac{3}{16} \mathrm{in}^{2}$
21.


Area $=\frac{1}{50} \mathrm{~m}^{2}$
22. SPEED You drive 15 miles in one-fourth hour. What is your average speed? $\qquad$
23. MAGNETIC TAPE A refrigerator magnet uses $\frac{5}{8}$ inch of magnetic tape. How many refrigerator magnets can you make with 10 inches of magnetic tape? Explain.

REVIEW: Dividing Mixed Numbers

## -Key Concepł and Vocabulary

## Rewrite as improper fractions. <br> $$
2 \frac{1}{2} \div 5=\frac{5}{2} \div \frac{5}{1}
$$ <br> $$
=\frac{5}{2} \times \frac{1}{5}
$$ <br> $$
=\frac{1}{2}
$$

Name

## Visual Model

Divide $2 \frac{1}{2}$ into five equal parts. Each part is $\frac{1}{2}$.

$$
2 \frac{1}{2} \div 5=\frac{1}{2}
$$



## Application Example

5. You need $2 \frac{1}{2}$ inches of ribbon to make a Blue-Ribbon award. How many awards can you make with 35 inches of ribbon?

$$
35 \div 2 \frac{1}{2}=\frac{35}{1} \div \frac{5}{2}=\frac{35}{1} \times \frac{2}{5}=14
$$

¿- You can make 14 awards.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Find the quotient. Write your answer as a whole or mixed number in simplest form.
6. $4 \frac{1}{2} \div 9=$ $\qquad$
7. $3 \frac{3}{7} \div 8=$ $\qquad$
8. $4 \frac{2}{3} \div 7=$ $\qquad$ 9. $1 \frac{7}{9} \div 4=$ $\qquad$
10. $8 \div 1 \frac{1}{3}=$ $\qquad$ 11. $32 \div 3 \frac{1}{5}=$ $\qquad$ 12. $11 \div 2 \frac{3}{4}=$ $\qquad$ 13. $9 \div 1 \frac{1}{2}=$ $\qquad$
14. $5 \frac{1}{2} \div \frac{1}{2}=$ $\qquad$ 15. $\frac{1}{2} \div 1 \frac{1}{2}=$
16. $1 \frac{1}{4} \div 1 \frac{1}{4}=$ $\qquad$ 17. $3 \frac{1}{2} \div 1 \frac{1}{3}=$ $\qquad$

## Find the missing dimension.

18. 


$\qquad$ ft
19.

20. RED RIBBONS You need $3 \frac{1}{2}$ inches of ribbon to make a Red-Ribbon award. How many awards can you make with 35 inches of ribbon? $\qquad$
21. SHIPPING You are stacking books into a shipping box that is 15 inches high. Each book is $1 \frac{1}{4}$ inches thick. How many books can you fit in a stack? $\qquad$
$\qquad$ Decimals


Skill Examples

1. 134.12
$\begin{array}{r}159.485 \\ \hline 159.605\end{array}$
2. 0.135
$\begin{array}{r}+0.14 \\ \hline 0.275\end{array}$

## Visual Model



## Application Example

5. Find the perimeter of the triangle.

$$
2.1+1.7+3.4=7.2
$$


3. 32.000
$\begin{array}{r}-9.451 \\ \hline 22.549\end{array}$
4. 1.405 $\frac{-0.55}{0.855}$

## PRACTICE makes PURR-FECT ${ }^{\text {in }}$

## Find the sum or difference.

6. $4.75+3.56=$ $\qquad$
7. $9.0-1.507=$ $\qquad$
8. $2.4+2.04=$ $\qquad$
9. $112.5+24.52=$ $\qquad$
10. $5.7-4.81=$ $\qquad$
11. $20-12.5=$ $\qquad$
12. $2.3+3.4+5.9=$ $\qquad$
13. $3.4+5.6-2.3=$ $\qquad$
14. $10.0-(4.5+2.3)=$ $\qquad$
Find the perimeter of the triangle.
15. 


Perimeter $=$ $\qquad$
16.

$\qquad$
17. SHOPPING You take $\$ 20$ to the store. You buy a magazine for $\$ 3.65$ and a birthday card for $\$ 5.29$. How much money do you have left? $\qquad$
18. NUMBER LINE Show the sum graphically on the number line: $1.75+3.5$.


REVIEW: Multiplying Decimals
Name $\qquad$

## Visual Model



Area $=2.5 \times 1.5=3.75$

## Application Example

4. Find the area of the rectangle.
$2.4 \times 4.1=9.84$
$\therefore$ The area is 9.84 square feet.

## PRACTICE makes PURR-FECT ${ }^{\text {Tm }}$

Find the product.
5. $3.02 \times 5.2=$ $\qquad$
6. $1.75 \times 1=$ $\qquad$
7. $(9.004)(0)=$ $\qquad$
8. $(4.05)^{2}=$ $\qquad$
9. $2.25 \times 4=$ $\qquad$
10. $(100.5)(90)=$ $\qquad$
11. $19.4 \times 5.05=$ $\qquad$
12. $(1.2)(1.3)(1.4)=$ $\qquad$
13. $115 \times 3.2=$ $\qquad$
14. $16(0.375)=$ $\qquad$
15. $(2.347)(1.8)=$ $\qquad$
16. $(1.5)^{3}=$ $\qquad$

## Find the area of the rectangle.

17. 


18.


Area $=$ $\qquad$
Area $=$ $\qquad$
19. APPLES Apples cost $\$ 3.45$ per pound. Find the cost of 2.6 pounds of apples. $\qquad$
20. PEACHES Peaches cost $\$ 4.29$ per pound. Find the cost of two and a quarter pounds of peaches.
Show your work. $\qquad$

REVIEW: Dividing Decimals
Name $\qquad$

## Visual Model

$$
12.5 \div 5=2.5
$$



When you divide 12.5 into 5 equal parts, each part will be 2.5.

## Skill Examples

1. $65.3 \div 10=6.53$
2. $65.3 \div 100=0.653$

Divide by a power of 10 by moving the decimal point.
3. $65.3 \div 1000=0.0653$
4. $65.3 \div 10,000=0.00653$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Application Example

5. A prize of $\$ 104.32$ is divided equally among four people. How much does each person get?

$$
104.32 \div 4=26.08
$$

$\therefore \quad$ Each person gets $\$ 26.08$.

## Find the quotient.

6. $5.2 \div 10=$ $\qquad$
7. $73.1 \div 100=$ $\qquad$
8. $1500 \div 1000=$ $\qquad$
9. $18.98 \div 3.65=$ $\qquad$
10. $0.598 \div 2=$ $\qquad$
11. $19.003 \div 1=$ $\qquad$
12. $3.42 \div 0.36=$ $\qquad$
13. $78.4 \div 1.4=$ $\qquad$
14. $1000 \div 12.5=$ $\qquad$
15. $0.45 \div 0.0125=$ $\qquad$ 16. $29.45 \div 4.75=$ $\qquad$ 17. $19.7 \div 0.1=$ $\qquad$

Find the width of the rectangle.
18.

19.

20. DRIVING TRIP You drive 1400 miles in 3.5 days. What is the average number of miles you drive per day? $\qquad$
21. METRIC SYSTEM There are 2.54 centimeters in one inch. How many inches are there in 51.78 centimeters? Round your answer to the nearest tenth of an inch. $\qquad$

REVIEW: Ratios


Name $\qquad$

## Visual Model



## Application Example

4. Write the ratio of basketballs to soccer balls in three ways.

There are 4 basketballs. There are 5 soccer balls.
$\because \frac{4}{5}, \quad 4$ to 5 , and $4: 5$

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$



Write the simplified ratio of green objects to blue objects in three ways.
5.

6.

7.

8.


## Write the simplified ratio of blue objects to all objects in three ways.

9. Frogs in Exercise 5
$\qquad$
10. Cars in Exericise 7
$\qquad$
11. CLASS RATIO The ratio of boys to girls in a class is 5 to 4 . There are 12 girls in the class. How many boys are in the class? $\qquad$

Name $\qquad$


## Skill Examples

1. You drive 100 miles in 2 hours.

Your unit rate is 50 miles per hour.
2. You earn $\$ 40$ in 5 hours.

Your unit rate is $\$ 8$ per hour.
3. You save $\$ 240$ in 6 months.

Your unit rate is $\$ 40$ per month.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Application Example

4. Janice was 44 inches tall when she was

8 years old. She was 52 inches tall when she was 12 years old. What was her unit rate?

She grew 8 inches in 4 years: $\frac{8}{4}=\frac{2}{1}$.

## Visual Model


$\because \quad$ Her unit rate is 2 inches per year.

Write the unit rate in words and as a fraction for each situation.
5. You fly 2000 miles in 4 hours.
Words
$\qquad$
Fraction
6. You pay 15 dollars for 3 pizzas. $\qquad$
Words
Fraction
7. You pay $\$ 4$ sales tax on a $\$ 50$ purchase. $\qquad$
Words
Fraction
8. You earn $\$ 25$ for mowing 5 lawns. $\qquad$
Words
Fraction

## Circle the name of the person with the greater unit rate.

9. Maria saves $\$ 50$ in 4 months.

Ralph saves $\$ 60$ in 5 months.
11. Kim earns $\$ 400$ for working 40 hours. Sam earns $\$ 540$ for working 45 hours.

## Convert the unit rate.

13. $\frac{60 \text { miles }}{1 \text { hour }}=\frac{\square \text { feet }}{1 \text { second }}$
14. John rides his bicycle 36 miles in 3 hours.

Randy rides his bicycle 30 miles in 2.5 hours.
12. Arlene scores 450 points on 5 tests. Jolene scores 180 points on 2 tests.

REVIEW: Direct Variation


Name $\qquad$

## Visual Model

For positive values of $x$ and $y$, as $x$ increases, $y$ increases.

$$
y=\frac{1}{2} x
$$



## Skill Example

1. Equation: $y=2 x$

Table:

| $\boldsymbol{x}$ | 0 | 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 2 | 4 | 6 | 8 | 10 |

Words: $y$ is twice the value of $x$.

## Application Example

2. The amount $y$ of gasoline a car uses is $\frac{1}{20}$ times the number $x$ of miles it travels. Make a table to show this relationship.

| $\boldsymbol{x}$ | 0 | 20 | 40 | 60 | 80 | 100 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 1 | 2 | 3 | 4 | 5 |

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Check your answers at BigIdeasMath.com.
Complete the table. Then sketch the graph.
3. $y=1.5 x$

| $x$ | $y$ |
| :---: | :---: |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |

4. $y=\frac{2}{3} x$

| $x$ | $y$ |
| :---: | :---: |
| 0 |  |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |



WRITING AN EQUATION Write a direct variation equation for the table.
5.

| $\boldsymbol{x}$ | 0 | 1 | 2 | 3 | 4 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 3 | 6 | 9 | 12 |

6. | $\boldsymbol{x}$ | 0 | 1 | 2 | 3 | 4 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 0.4 | 0.8 | 1.2 | 1.6 |
7. WALRUS The amount $y$ that a walrus eats is directly proportional to its weight $x$. A 4000 pound walrus eats 20 pounds each day. How much does a 2000 pound walrus eat each day? $\qquad$

REVIEW: Proportions


## Skill Examples

1. $\frac{3}{5}=\frac{12}{20} \quad$ is a proportion because the cross products are equal.
2. $\frac{1}{7}=\frac{7}{48}$
is not a proportion because the cross products are not equal.
3. $\frac{10}{2}=\frac{5}{1}$
is a proportion because the cross products are equal.

Name $\qquad$

## Visual Model

The ratio " 2 to 3 " is equal to the ratio " 4 to 6 ."


## Application Example

4. You spend $\$ 5$ for 3 tennis balls. Your friend spends $\$ 6.25$ for 4 tennis balls. Are the two rates proportional?

$$
\frac{\$ 5}{3 \text { balls }} \stackrel{?}{=} \frac{\$ 6.25}{4 \text { balls }} \quad 5(4) \neq 3(6.25)
$$

$\because$ The rates are not proportional.

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$

Decide whether the statement is a proportion.
5. $\frac{3}{7}=\frac{6}{14}$ $\qquad$ 6. $\frac{1}{4}=\frac{4}{1}$ $\qquad$ 7. $\frac{3}{2}=\frac{9}{4}$
8. $\frac{1.25}{3}=\frac{5}{12}$ $\qquad$ 9. $\frac{6}{18}=\frac{120}{360}$ $\qquad$ 10. $\frac{4}{5}=\frac{4+4}{5+5}$
$\qquad$

Complete the proportion.
11. $\frac{2}{5}=\frac{\square}{10}$
12. $\frac{1}{6}=\frac{4}{\square}$
13. $\frac{3}{\square}=\frac{9}{24}$

Write the proportion that compares the circumference to the radii of the two circles.
14.


15.

16. COMPARING RATES You spend $\$ 20$ for 5 T -shirts. Your friend spends $\$ 15$ for 3 T -shirts. Are the two rates proportional? $\qquad$
$\qquad$

## Systems With Benchmarks



## Visual Model


$1 \mathrm{in} . \approx 3 \mathrm{~cm}$

## Application Example

5. A person is 63 inches tall. How many centimeters is that?

$$
\begin{aligned}
63 \mathrm{in} . & \approx 63 \mathrm{in} . \cdot \frac{3 \mathrm{~cm}}{1 \text { in. }} \\
& =189 \mathrm{~cm}
\end{aligned}
$$

$\therefore$ The height of the person is about 189 centimeters.

## PRACTICE MAKES PURR-FECT ${ }^{\text {m }}$

## Complete the unit conversion.

6. $26 \mathrm{mi} \approx \ldots \mathrm{km}$
$\qquad$ 7. $150 \mathrm{~g} \approx$ $\qquad$ OZ
7. $2 \mathrm{~L} \approx$ $\qquad$ qt
8. $70 \mathrm{lb} \approx$ $\qquad$ kg
9. $12 \mathrm{ft} \approx$ $\qquad$ m
10. $16 \mathrm{~km} \approx$ $\qquad$ mi
11. $36 \mathrm{~cm} \approx$ $\qquad$ in.
12. $7 \mathrm{gal} \approx$ $\qquad$ L
13. $9 \mathrm{qt} \approx$ $\qquad$ L
14. $800 \mathrm{~mL} \approx$ $\qquad$ c
15. $5 \mathrm{gal} \approx$ $\qquad$ $\mathrm{cm}^{3}$
16. $12 \mathrm{~m}^{3} \approx$ $\qquad$ gal
17. WEIGHT How much does the wolf weigh in pounds?

18. SPEED A hummingbird flies at a speed of 33 feet per second. What is the speed of the hummingbird in meters per second?


REVIEW: Fractions and Decimals
Name $\qquad$

## Skill Examples

1. $0.6=\frac{6}{10}=\frac{3}{5}$
2. $\frac{4}{5}=\frac{4 \cdot 2}{5 \cdot 2}=\frac{8}{10}=0.8$
3. $0.875=\frac{875}{1000}=\frac{7 \cdot 125}{8 \cdot 125}=\frac{7}{8}$
4. $\frac{1}{3}=0.333 \ldots=0 . \overline{3} \quad \frac{0.3333 \ldots}{31.0000 \ldots}$

## Visual Model

$$
\frac{1}{4}=0.25
$$


$=$

## Application Example

5. You put 16.75 gallons of gas in your car.

Write this decimal as a mixed number.

$$
16.75=16+0.75=16 \frac{3}{4}
$$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Write the fraction as a decimal.
6. $\frac{3}{4}=$ $\qquad$
7. $\frac{7}{10}=$ $\qquad$
8. $\frac{3}{25}=$ $\qquad$
9. $\frac{7}{20}=$
$\qquad$
10. $\frac{19}{100}=$ $\qquad$
11. $\frac{11}{50}=$ $\qquad$
12. $\frac{2}{3}=$ $\qquad$
13. $\frac{1}{6}=$ $\qquad$

## Write the decimal as a fraction.

14. $0.4=$ $\qquad$
15. $0.35=$ $\qquad$ 16. $0.6=$ $\qquad$ 17. $1.5=$ $\qquad$

## Write the number represented by the model as a decimal and as a simplified fraction.

18. $\qquad$ $=$ $\qquad$

19. $\qquad$ $=$ $\qquad$

20. $\qquad$ $=$ $\qquad$
21. GAS You put 9.25 gallons of gas in your car. Write this decimal as a mixed number. $\qquad$
22. MULTIPLE FORMS Write the decimal 0.35 in two ways. One with a denominator of 100 and one with a denominator of 1000 . $\qquad$

REVIEW: Percents and Fractions
Name $\qquad$
Key Concept and Vocabulary

$$
35 \%=\frac{35}{100}=\frac{5 \cdot 7}{5 \cdot 20}=\frac{7}{20}
$$

Write percent as a fraction in simplest form.

Visual Model $\quad 35 \%=\frac{7}{20}$


## Application Example

5. Your school's softball team won $30 \%$ of its games. Did the team win more than one-fourth of its games?

$$
30 \%=\frac{3}{10} \quad \frac{3}{10}>\frac{1}{4}
$$

$\therefore$ Yes, the team won more than one-fourth of its games.

## PRACTICE makes PURR-FECT

## Write the percent as a fraction in simplest form.

6. $20 \%=$ $\qquad$
7. $45 \%=$ $\qquad$
8. $7 \%=$ $\qquad$
9. $32.5 \%=$ $\qquad$
10. $15 \%=$ $\qquad$
11. $1 \%=$ $\qquad$
12. $150 \%=$ $\qquad$
13. $33 \frac{1}{3} \%=$ $\qquad$

## Write the fraction as a percent.

14. $\frac{3}{20}=$ $\qquad$ 15. $\frac{6}{5}=$ $\qquad$ 16. $\frac{5}{8}=$ $\qquad$ 17. $\frac{3}{5}=$ $\qquad$
Write the fraction represented by the model as a percent.
15. 


19.

20.

21. SURVEY Eighteen out of twenty people in a survey said that vanilla ice cream is their favorite flavor of ice cream. What percent is this? $\qquad$
22. SPANISH LANGUAGE Twelve of the 40 students in your class can speak Spanish.

What percent is this? $\qquad$

REVIEW: Percents and Decimals
Name $\qquad$

## Skill Examples

## Visual Model

$18 \%=0.18$


|  |  | $A$ |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

## Application Example

1. $18 \%=0.18$
2. $145 \%=1.45$
3. $0.005=0.5 \%$ (one-half of one percent)
4. What percent of the circle graph is represented by the yellow region?

$$
0.36=36 \%
$$


4. $0.125=12.5 \%$

## PRACTICE Makes PURR-FECT ${ }^{\text {m" }}$

Check your answers at BigIdeasMath.com.
Write the percent as a decimal.
6. $20 \%=$ $\qquad$
7. $45 \%=$ $\qquad$
8. $7 \%=$ $\qquad$
9. $32.5 \%=$ $\qquad$
10. $15 \%=$ $\qquad$
11. $1 \%=$ $\qquad$
12. $150 \%=$ $\qquad$
13. $0.2 \%=$ $\qquad$

## Write the decimal as a percent.

14. $0.13=$ $\qquad$
15. $1.4=$ $\qquad$
16. $0.001=$ $\qquad$
17. $2.5=$ $\qquad$

What percent of the circle graph is represented by the yellow region?
18.

19.

20.

21. BUDGET You have set aside two twenty-fifths of your monthly budget for clothing. What percent is this? $\qquad$
22. SUMMER SCHOOL Eighty-seven percent of the students in your class do not plan to attend summer school. What percent of your class plans to attend summer school? $\qquad$

REVIEW: Finding the Percent of a Number

Name $\qquad$


## Skill Examples

1. $30 \%$ of $50: ~ 0.3 \times 50=15$
2. $45 \%$ of $80: 0.45 \times 80=36$
3. $110 \%$ of $40: 1.1 \times 40=44$

Visual Model


## Application Example

5. $28 \%$ of the 200 people who answered a survey own a dog. How many of the 200 people in the survey own a dog?
$0.28 \times 200=56$
$\therefore 56$ of the 200 people own a dog.

## PRACTICE MAKES PURR-FECT ${ }^{\text {TM }}$

Check your answers at BigIdeasMath.com.
Find the percent of the number.
6. $25 \%$ of $40=$ $\qquad$ 7. $20 \%$ of $35=$ $\qquad$ 8. $65 \%$ of $110=$ $\qquad$ 9. $125 \%$ of $20=$ $\qquad$
10. $33 \frac{1}{3} \%$ of $60=$ $\qquad$ 11. $95 \%$ of $400=$ $\qquad$ 12. $200 \%$ of $31=$ $\qquad$ 13. $18 \%$ of $90=$ $\qquad$
14. $1 \%$ of $800=$ $\qquad$ 15. $60 \%$ of $60=$ $\qquad$ 16. $100 \%$ of $59=$ $\qquad$ 17. $1000 \%$ of $59=$ $\qquad$
Write the question represented by the model. Then answer the question.
18.


Question: $\qquad$
Answer: $\qquad$


Question: $\qquad$
Answer: $\qquad$
20. ENDANGERED SPECIES Sixty percent of a species of butterfly died due to loss of habitat.

Originally, there were 10,000 butterflies. How many are left? $\qquad$
21. SALES TAX You buy 4 breakfast sandwiches at $\$ 2.59$ each, 4 hashbrowns at $\$ 1.10$ each, and 4 bottles of orange juice at $\$ 1.25$ each. The sales tax is $6 \%$. Find the total cost of the 4 meals, including sales tax. $\qquad$

REVIEW: Percents and Proportions

## Key Concept and Vocabulary

To represent " $a$ is $p$ percent of $w$,"use a proportion.


## Skill Examples

1. $\frac{36}{50}=\frac{p}{100}$
$100 \cdot \frac{36}{50}=100 \cdot \frac{p}{100}$
$72=p$
$\because \quad$ So, 36 is $72 \%$ of 50 .
2. $\frac{a}{36}=\frac{20}{100}$
$36 \cdot \frac{a}{36}=36 \cdot \frac{20}{100}$

$$
a=7.2
$$

$\because \quad$ So, 7.2 is $20 \%$ of 36 .

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$

Write and solve a proportion to answer the question.
4. 68 is what percent of 80 ?
6. 36 is $16 \%$ of what number?
8. What number is $64 \%$ of 40 ?
5. What number is $25 \%$ of 116 ?
7. 48 is what percent of 128 ?
9. 77 is $55 \%$ of what number?
$\qquad$
10. PLAY Students are auditioning for a play. Of the 60 students auditioning, 12 will get a part in the play. What percent of the students who audition will get a part in the play?
$\qquad$
11. HOMEWORK You have completed $60 \%$ of your English homework. The assignment has 25 questions. How many questions are left? $\qquad$

REVIEW: Estimating and Finding a Tip

## Key Concept and Vocabulary

To find the tip on a food bill at a restaurant, write the percent as a decimal or fraction and multiply it by the cost of the food bill.


Name $\qquad$

## Visual Model



## Application Examples

1. Your food bill at a restaurant is $\$ 8.49$. You leave a $15 \%$ tip.

Estimate: Round 8.49 to 10 .

$$
0.15 \times 10=1.5
$$

$\because$ The estimate for the tip is $\$ 1.50$.
Actual: $0.15 \times 8.49 \approx 1.27$
$\therefore$ The actual tip is $\$ 1.27$.
2. Your food bill at a restaurant is $\$ 15.83$. You leave a $20 \%$ tip.

Estimate: Round 15.83 to 16 .
$0.2 \times 16=3.2$
$\because$ The estimate for the tip is $\$ 3.20$.
Actual: $0.2 \times 15.83 \approx 3.17$
$\therefore$ The actual tip is $\$ 3.17$.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Check your answers at BigIdeasMath.com.

## Estimate the tip. Then find the actual tip.

3. Food bill: $\$ 33.65$; Tip: $15 \%$ $\qquad$
4. Food bill: $\$ 44.28$; Tip: $20 \%$ $\qquad$
5. Food bill: $\$ 11.17$; Tip: $15 \%$ $\qquad$
6. Food bill: $\$ 12.37$; Tip: $20 \%$ $\qquad$
7. Food bill: $\$ 23.16$; Tip: $15 \%$ $\qquad$
8. Food bill: $\$ 16.21$; Tip: $20 \%$ $\qquad$
9. Food bill: $\$ 37.54$; Tip: $25 \%$ $\qquad$
10. Food bill: $\$ 25.96$; Tip: $20 \%$ $\qquad$
11. Food bill: $\$ 28.93$; Tip: $15 \%$ $\qquad$
12. Food bill: $\$ 72.79$; Tip: $25 \%$ $\qquad$
13. Food bill: $\$ 19.82$; Tip: $23 \%$ $\qquad$
14. Food bill: $\$ 51.56$; Tip: $30 \%$ $\qquad$

REVIEW: Estimating and Finding a Sales Tax

## Key Concept and Vocabulary

To find the sales tax on an item, write the percent as a decimal or fraction and multiply it by the price of the item.


Name $\qquad$

Visual Model


Using a sales tax of $5 \%$, the sales tax on a $\$ 25$ shirt is $\$ 1.25$.

## Application Examples

1. $A$ DVD costs $\$ 20$ before tax. The sales tax is $7 \%$.

Estimate: Round 7\% to 5\%.

$$
0.05 \times 20=1
$$

$\because$ The estimate for the sales tax is $\$ 1$.
Actual: $0.07 \times 20=1.4$
$\therefore$ The actual sales tax is $\$ 1.40$.
2. A bicycle costs $\$ 115$ before tax. The sales tax is $9 \%$.

Estimate: Round $9 \%$ to $10 \%$ and 115 to 120 .
$0.1 \times 120=12$
$\because$ The estimate for the sales tax is $\$ 12$.
Actual: $0.09 \times 115=10.35$
$\because \quad$ The actual sales tax is $\$ 10.35$.

## PRACTICE makes PURR-FECT ${ }^{\text {TM }}$

## Estimate the sales tax. Then find the actual sales tax.

3. BASEBALL CARDS The pack of baseball cards costs $\$ 3.75$ before tax. The sales tax is $4 \%$.
4. TELEVISION A television costs $\$ 400$ before tax. The sales tax is $8 \%$.
5. MP3 PLAYER An MP3 player costs $\$ 89$ before tax. The sales tax is $6 \%$.
6. COUCH A couch costs $\$ 675$ before tax. The sales tax is $5 \%$.
7. GUITAR A guitar costs $\$ 299$ before tax. The sales tax is $9 \%$.
8. TABLE A table costs $\$ 50$ before tax. The sales tax is $4.5 \%$.
9. JEANS A pair of jeans costs $\$ 39$ before tax. The sales tax is $5.5 \%$.
$\qquad$ Finding a Discount

## Key Concept and Vocabulary

A discount is a decrease in the original price of an item. To find the discount, write the percent as a decimal or fraction and multiply it by the original price of the item.


Visual Model

| 0\% | 20\% | 40\% | 60\% | 80\% | 100\% |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | , |  | ! |  |  |
| 0 | 15 | 30 | 45 | 60 | 75 |
|  | The sale price of a $\$ 75$ necklace with a $60 \%$ discount is $\$ 75-\$ 45=\$ 30$. |  |  |  |  |

## Application Examples

1. The original price of a book is $\$ 18.79$.

The discount is $20 \%$.
Estimate: Round 18.79 to 20 .

$$
0.2 \times 20=4
$$

$\because$ The estimate for the discount is $\$ 4$.
Actual: $0.2 \times 18.79 \approx 3.76$
$\therefore$ The actual discount is $\$ 3.76$. The sale price of the book is $\$ 18.79-\$ 3.76=\$ 15.03$.
2. The original price of a pair of in-line skates is $\$ 209.99$. The discount is $15 \%$.

Estimate: Round 209.99 to 200.

$$
0.15 \times 200=30
$$

$\because$ The estimate for the discount is $\$ 30$.
Actual: $0.15 \times 209.99 \approx 31.50$
$\because$ The actual discount is $\$ 31.50$. The sale price of the pair of in-line skates is $\$ 209.99-\$ 31.50=\$ 178.49$.

## PRACTICE makes PURR-FECT

Estimate the discount. Then find the actual discount and the sale price.
3. TRUMPET The original price of a trumpet is $\$ 319.29$. The discount is $25 \%$.
4. SHOES The original price of a pair of shoes is $\$ 47.99$. The discount is $40 \%$.
5. LAMP The original price of a lamp is $\$ 17.09$. The discount is $15 \%$.
$\qquad$
6. RING The original price of a ring is $\$ 96.75$. The discount is $60 \%$.
7. ELECTRONICS The original price of a home theater system is $\$ 243.89$. The discount is $75 \%$.
$\qquad$
8. BASEBALL The original price of a baseball glove is $\$ 26.99$. The discount is $30 \%$.
9. SEWING MACHINE The original price of a sewing machine is $\$ 182.96$. The discount is $20 \%$.
$\qquad$ and Multiplication

## Key Concept and Vocabulary

Associative Properties:
$(a+b)+c=a+(b+c)$
$(a \cdot b) \cdot c=a \cdot(b \cdot c)$
Distributive Property:
$a(b+c)=a b+a c$
$a(b-c)=a b-a c$
Inverse Properties:
$a+(-a)=-a+a=0$
$a \cdot \frac{1}{a}=\frac{1}{a} \cdot a=1, a \neq 0$

Commutative Properties:
$a+b=b+a$
$a \cdot b=b \cdot a$
Identity Properties:
$a+0=0+a=a$
$a \cdot 1=1 \cdot a=a$
Multiplication Properties of 0 and -1 :
$a \cdot 0=0 \cdot a=0$
$a \cdot(-1)=(-1) \cdot a=-a$

## Skill Examples

## Identify the property illustrated.

1. $-2 \cdot(7 \cdot 5)=-2 \cdot(5 \cdot 7)$
Commutative Property of Multiplication
2. $3(6 x+2)=18 x+6$

Distributive Property
2. $(-8) \cdot 1=-8$

Identity Property of Multiplication
4. $(w+3)+7=w+(3+7)$

Associative Property of Addition

Check your answers at BigIdeasMath.com.
Identify the property illustrated.
5. $(9 \cdot 4) \cdot 5=9 \cdot(4 \cdot 5)$
6. $(-1) \cdot(-12)=12$
$\qquad$
7. $2 a+(-2 a)=0$
8. $0+11 c=11 c$
$\qquad$
9. $9 m \cdot 0=0$
$\qquad$
11. $7 n-4 n=(7-4) n$
12. $\frac{1}{15 d} \cdot 15 d=1$
$\qquad$
13. $x+(y+6)=(x+y)+6$
14. $\left(\frac{1}{16} k\right)(-32)=(-32)\left(\frac{1}{16} k\right)$
$\qquad$
10. $(5-2 b)+3=(-2 b+5)+3$
$\qquad$
$\qquad$

REVIEW: Distributive Property
Name $\qquad$


## Skill Examples

1. $3(9+4)=3 \cdot 9+3 \cdot 4$
2. $7(10-3)=7 \cdot 10-7 \cdot 3$
3. $6 \cdot 8+6 \cdot 7=6(8+7)$
4. $12 \cdot 9-12 \cdot 2=12(9-2)$
5. $5(2+5+3)=5 \cdot 2+5 \cdot 5+5 \cdot 3$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Application Example

6. You buy 3 hot dogs for $\$ 1.25$ each and 3 sodas for $\$ 0.75$ each. Find the total cost.

$$
\begin{aligned}
3(1.25)+3(0.75) & =3(1.25+0.75) \\
& =3(2.00) \\
& =6
\end{aligned}
$$

Use the Distributive Property to rewrite the expression.
7. $3(4+5)=$ $\qquad$ 8. $5(8-3)=$ $\qquad$ 9. $9(11+7)=$ $\qquad$
10. $8(27-9)=$ $\qquad$ 11. $6(17-7)=$ $\qquad$ 12. $4(7+3+2)=$ $\qquad$
13. $5 \cdot 7+5 \cdot 3$ $\qquad$ 14. $2 \cdot 9-2 \cdot 6=$ $\qquad$ 15. $7 \cdot 4+7 \cdot 8=$ $\qquad$
16.

17.

18. MENTAL MATH You buy 5 hot dogs for $\$ 1.29$ each and 5 sodas for $\$ 0.71$ each. Show how you can use mental math to find the total cost.
19. EXTENSION Does the Distributive Property apply to a combination of addition and subtraction? Decide using the expression 3(7+5-4).
$\qquad$
$\qquad$

REVIEW: Comparing, Ordering, and Graphing Integers


## Skill Examples

1. $0 \leq 4 \quad$ " 0 is less than or equal to 4 "
2. $-1>-3$ " -1 is greater than -3 "
3. $-2<-1$ " -2 is less than -1 "
4. $2>-2$ " 2 is greater than -2 "
5. $3 \geq 2 \quad$ " 3 is greater than or equal to 2 "

Name $\qquad$

## Visual Model

Number Line

$-4<2$ because -4 is to the left of 2 on the number line.

## Application Example

6. The temperature in Seattle is $4^{\circ} \mathrm{F}$.

The temperature in Denver is $-6^{\circ} \mathrm{F}$. Which temperature is greater?

$$
-6<4 \quad "-6 \text { is less than } 4 "
$$

$\because \quad$ The temperature is greater in Seattle.

## PRACTICE MAKES PURR-FECT ${ }^{\text {m }}$

Check your answers at BigIdeasMath.com.
Graph the two numbers. Then compare them using < or >.
7. $-3 \square 2$

8. -1


9. -1

10. 1

11. 0 $\square$

12. 3


Order the temperatures from least to greatest.
13. $-5^{\circ} \mathrm{F}, 13^{\circ} \mathrm{F}, 0^{\circ} \mathrm{F}, 5^{\circ} \mathrm{F}, 2^{\circ} \mathrm{F}, 20^{\circ} \mathrm{F}$
14. $7^{\circ} \mathrm{C},-4^{\circ} \mathrm{C},-11^{\circ} \mathrm{C}, 0^{\circ} \mathrm{C}, 8^{\circ} \mathrm{C},-12^{\circ} \mathrm{C}$

Use an integer to describe the real-life situation.
15. A profit of $\$ 5$ $\qquad$
A loss of \$5 $\qquad$
16. A depth of 8 ft $\qquad$
A height of 4 ft $\qquad$
17. A decrease of $5^{\circ} \mathrm{F}$ $\qquad$
An increase of $8^{\circ} \mathrm{F}$ $\qquad$
18. BUSINESS LOSS During its first week, a business had a loss that was greater than $\$ 4$, but less than $\$ 6$. Circle each integer that could represent this loss.
$-\quad-\quad \$ 6, \quad-\$ 5, \quad-\$ 4, \quad-\$ 3, \quad-\$ 2, \quad-\$ 1, \quad \$ 0, \quad \$ 1, \quad \$ 2, \quad \$ 3, \quad \$ 4, \quad \$ 5, \quad \$ 6, \quad \$ 7$

REVIEW: Adding and Subtracting Integers

Key Concept and Vocabulary


Name $\qquad$

## Visual Model

To add a positive number, move to the right.


To subtract a positive number, move to the left.

## Skill Examples

1. $5+(-3)=5-3=2$
2. $5-(-2)=5+2=7$ R
3. $-2+4=2$
4. $-3-(-2)=-3+2=-1<$
5. $8-(-3)=8+3=11$

To subtract, change the sign and add.

## PRACTICE makes PURR-FECT ${ }^{\text {me }}$

## Application Example

6. The temperature is $8^{\circ} \mathrm{F}$ in the morning and drops to $-5^{\circ} \mathrm{F}$ in the evening. What is the difference between these temperatures?

$$
\begin{aligned}
8-(-5) & =8+5 \\
& =13
\end{aligned}
$$

$\therefore$ The difference is 13 degrees.

Find the sum or difference.
7. $-2+3=$ $\qquad$
8. $-4-5=$ $\qquad$
9. $8-2=$ $\qquad$
10. $8-(-2)=$ $\qquad$
11. $-4-(-1)=$ $\qquad$
12. $-5+(-5)=$ $\qquad$
13. $4-(-8)=$ $\qquad$
14. $4-8=$ $\qquad$
15. $-4+(-6)=$ $\qquad$ 16. $-4-(-6)=$ $\qquad$ 17. $10-13=$ $\qquad$ 18. $13-(-10)=$ $\qquad$

## Write the addition or subtraction shown by the number line.

19. 


20.

21. TEMPERATURE The temperature is $16^{\circ} \mathrm{F}$ in the morning and drops to $-15^{\circ} \mathrm{F}$ in the evening. What is the difference between these temperatures? $\qquad$
22. SUBMARINE A submarine is 450 feet below sea level. It descends 300 feet. What is its new position? Show your work.
$\qquad$
$\qquad$

REVIEW: Multiplying and Dividing Integers

Key Concept and Vocabulary

$\qquad$

## Visual Model

$$
4 \cdot(-2)=(-2)+(-2)+(-2)+(-2)
$$



## Application Example

6. Each of your six friends owes you $\$ 5$. Use integer multiplication to represent the total amount your friends owe you.

$$
6 \cdot(-5)=-30
$$

$\therefore$ The total amount owed is $\$ 30$.

## Skill Examples

1. $-3 \cdot(-4)=12$
2. $-36 \div(-6)=6$
same sign, product and quotient positive
3. $-7 \cdot 0=0$
4. $-10 \div 5=-2 \longleftarrow$ different signs, product
5. $-5 \cdot 6=-30$ and quotient negative

## PRACTICE maKes PURR-FECT ${ }^{\text {™ }}$

Check your answers at BigIdeasMath.com.

## Find the product or quotient.

7. $-3 \times(-5)=$ $\qquad$
8. $7(-3)=$ $\qquad$
9. $0 \cdot(-5)=$ $\qquad$ 10. $(-5)(-7)=$ $\qquad$
10. $-8 \cdot 2=$ $\qquad$
11. $(-5)^{2}=$ $\qquad$
12. $(-3)^{3}=$ $\qquad$
13. $4(-2)(-3)=$ $\qquad$
14. $-16 \div 4=$ $\qquad$ 16. $-20 \div(-5)=$ $\qquad$ 17. $\frac{-9}{3}=$ $\qquad$ 18. $\frac{-20}{-10}=$ $\qquad$

Complete the multiplication or division equation.
19. $-15 \div$ $\qquad$ $=-3$
20. $45 \div$ $\qquad$ $=-5$
21. $\quad \div(-20)=5$
22. 8 • $\qquad$ $=-64$
23. $\qquad$ $\cdot(-9)=27$
24. -12 • $\qquad$ $=-96$
25. TOTAL OWED Each of your eight friends owes you $\$ 10$. Use integer multiplication to represent the total amount your friends owe you. $\qquad$
26. TEMPERATURE The low temperatures for a week in Edmonton, Alberta are $-15^{\circ} \mathrm{C}$, $-12^{\circ} \mathrm{C},-10^{\circ} \mathrm{C},-12^{\circ} \mathrm{C},-18^{\circ} \mathrm{C},-20^{\circ} \mathrm{C}$, and $-25^{\circ} \mathrm{C}$. What is the mean low temperature for the week? Show your work.
$\qquad$
$\qquad$

## Operations with Rational Numbers

To add, subtract, multiply, or divide rational numbers, use the same rules for signs as you used for integers.

Example 1 Find (a) $-\frac{5}{6}+\frac{2}{3}$ and (b) $7.3-(-4.8)$.
a. Write the fractions with the same denominator, then add.

$$
-\frac{5}{6}+\frac{2}{3}=-\frac{5}{6}+\frac{4}{6}=\frac{-5+4}{6}=\frac{-1}{6}=-\frac{1}{6}
$$

b. To subtract a rational number, add its opposite.

$$
7.3-(-4.8)=7.3+4.8=12.1 \quad \text { The opposite of }-4.8 \text { is } 4.8
$$

Example 2 Find (a) $2.25 \cdot 8$, (b) $-2.25 \cdot(-8)$, and (c) $-2.25 \cdot 8$.
a. $2.25 \cdot 8=18$
b. $-2.25 \cdot(-8)=18$
c. $-2.25 \cdot 8=-18$

Example 3 Find $-\frac{4}{9} \div \frac{3}{4}$.
To divide by a fraction, multiply by its reciprocal.

$$
-\frac{4}{9} \div \frac{3}{4}=-\frac{4}{9} \cdot \frac{4}{3}=-\frac{4 \cdot 4}{9 \cdot 3}=-\frac{16}{27} \quad \text { The reciprocal of } \frac{3}{4} \text { is } \frac{4}{3} .
$$

## Practice

## Add, subtract, multiply, or divide.

1. $-7.5+3.8$
2. $-18.3+(-6.7)$
3. $0.6-0.85$
4. $6.13-(-2.82)$
5. $-6 \cdot 4.75$
6. $-3.2 \cdot(-4.8)$
7. $-1.8 \div(-9)$
8. $3.6 \div(-1.5)$
9. $-\frac{1}{6}+\frac{5}{6}$
10. $-\frac{7}{10}+\left(-\frac{3}{5}\right)$
11. $\frac{4}{9}-\frac{2}{3}$
12. $-\frac{5}{6}-\frac{1}{4}$
13. $-\frac{3}{2} \cdot\left(-\frac{1}{8}\right)$
14. $-\frac{3}{4} \cdot \frac{7}{12}$
15. $\frac{5}{8} \div\left(-\frac{1}{4}\right)$
16. $-\frac{4}{7} \div \frac{2}{5}$
17. TEMPERATURE The temperature at midnight is shown. The outside temperature decreases $2.3^{\circ} \mathrm{C}$ over the next two hours. What is the outside temperature at 2 А.м.?
18. SNOWFALL In January, a city's snowfall was $\frac{5}{8}$ foot below the historical average. In February, the snowfall was $\frac{3}{4}$ foot above the historical average. Was the city's snowfall in the two-month period above or below the historical average? By how much?


REVIEW: Writing and Graphing Inequalities


## Skill Examples

1. $x>0$ : All positive numbers
2. $x \geq 0$ : All nonnegative numbers
3. $x<0$ : All negative numbers
4. $x \leq 0$ : All nonpositive numbers

Name $\qquad$

## Visual Model



## Application Example

5. A sign at a clothing store reads "Savings up to $70 \%$." Let $S$ represent the percent of savings. Write an inequality to describe $S$.
$S$ can be equal to $70 \%$.
Or $S$ can be less than $70 \%$.

## PRACTICE maKes PURR-FECT ${ }^{\text {Tm }}$

Check your answers at BigIdeasMath.com.

## Write an inequality for the statement.

6. All numbers that are less than 24
7. All numbers greater than 10
8. All numbers that are at least 11

## Graph the inequality.

12. $x>-1$

13. $x \leq 3$

14. All numbers that are at most 3
15. All numbers that are no more than 5
16. All numbers less than or equal to 8
$\qquad$
17. $x<4$

18. $x \geq 0$

19. A sign at a shoe store reads "Savings up to $60 \%$." Let $P$ represent the percent of savings. Write an inequality to describe $P$.


REVIEW: Writing Expressions and Equations
Key Concept and Vocabulary
Phrase: Two more than a number
Expression: $2+n$
Sentence: Two more than a
number is equal to six.
Equation: $2+n=6$

## Skill Examples

1. Five times a number: $5 n$
2. Six less than three times a number: $3 n-6$
3. The sum of a number and one: $n+1$
4. A number divided by three: $n \div 3$

Name $\qquad$

## Visual Model



## Application Example

5. Write an equation for the following. "The price of $\$ 15$ is the wholesale cost plus a markup of fifty percent."
Let $C$ be the wholesale cost. $50 \%$ of $C$ is $0.5 C$.

## PRACTICE makes PURR-FECT ${ }^{\text {Tm }}$

Write the verbal phrase as a mathematical expression.
6. The product of a number and two
8. 19 less than twice a number
$\qquad$
10. Five times the sum of a number and two

## Write the sentence as an equation.

12. Three times a number equals nine.
13. Twelve divided by a number is four.
14. The volume of a cone is one-third the area of the base times the height. A cone has a volume of $20 \pi$ cubic inches. Write an equation that can be used to solve for the height of the cone.


REVIEW: Evaluating Expressions
Name $\qquad$
Key Concept and Vocabulary
$\begin{aligned} & \text { Expression: } 2 x^{2}+3 x-6 \\ & \text { Evaluate when } x=2 \text {. } \\ & 2\left(2^{2}\right)+3(2)-6=8+6-6 \\ &=8\end{aligned}$

## Skill Examples

1. When $x=5,3 x+4$ is $3(5)+4=19$.
2. When $x=-1,5 x+7$ is $5(-1)+7=2$.
3. When $x=3,4 x^{2}$ is $4\left(3^{2}\right)=36$.
4. When $x=4, x^{3}+1$ is $4^{3}+1=65$.

## Visual Model

| $\boldsymbol{x}$ | $\mathbf{2} \boldsymbol{x}+\mathbf{3}$ | Value of Expression |
| :---: | :---: | :---: |
| 1 | $2(1)+3$ | 5 |
| 2 | $2(2)+3$ | 7 |
| 3 | $2(3)+3$ | 9 |
| 4 | $2(4)+3$ | 11 |

## Application Example

5. For a Celsius temperature $C$ the Fahrenheit temperature $F$ is $\frac{9}{5} C+32$. Find $F$ when $C=25^{\circ}$.

$$
\begin{aligned}
\frac{9}{5} C+32 & =\frac{9}{5}(25)+32 \\
& =45+32 \\
& =77
\end{aligned}
$$

$\because$ The Fahrenheit temperature is $77^{\circ}$.

Check your answers at BigIdeasMath.com.

## Evaluate the expression.

6. When $x=2,3 x-1=$ $\qquad$ .
7. When $x=4, x^{2}-5=$ $\qquad$ -.
8. When $x=3.1,5 x+0.5=$ $\qquad$ .
9. When $x=10, x^{2}-8 x+11=$ $\qquad$ .

## Evaluate the perimeter when $x=3$.

14. 


$P=$ $\qquad$
15.
$P=$ $\qquad$
16. CARDINAL The weight of the cardinal (in ounces) is $0.6 x+11$ after its eats $x$ ounces of bird seed. How much does it weigh after it eats 2 ounces of bird seed? $\qquad$
7. When $x=-1,3 x+9=$ $\qquad$
9. When $x=\frac{1}{2}, 3 x^{2}=$ $\qquad$
11. When $x=0,4 x^{2}+5=$ $\qquad$ .
13. When $x=2 \frac{1}{2}, 6 x+3=$ $\qquad$ .


REVIEW: Simplifying Expressions
Name $\qquad$

## Visual Model



## Application Example

5. The original cost of a shirt is $x$ dollars. The shirt is on sale for $30 \%$ off. Write a simplifed expression for the sale cost.

## 30\% Off

$$
x-0.3 x=0.7 x
$$

## PRACTICE makes PURR-FECT ${ }^{\text {TM }}$

Check your answers at BigIdeasMath.com.
Simplify the expression. (Remove parentheses and combine like terms.)
6. $4 x+6 x=$ $\qquad$
8. $9 x+3-6 x-2=$ $\qquad$
10. $7 m-2 m+5 m=$ $\qquad$
12. $(3 x+6)-x=$ $\qquad$
14. $(x+6)-(x+6)=$ $\qquad$
16. $(5 x+4)-2(x+1)=$ $\qquad$
7. $3 n+5-2 n=$ $\qquad$
9. $3(x+2)=$ $\qquad$
11. $2-(x+1)=$ $\qquad$
13. $5-(1-n)=$ $\qquad$
15. $(4 x-2)+3(x+1)=$ $\qquad$
17. $5(x+2)-2(x+2)=$ $\qquad$

## Write a simplified expression for the perimeter of the rectangle or triangle.

18. 



Perimeter $=$ $\qquad$
19.


Perimeter $=$ $\qquad$
20.


Perimeter $=$ $\qquad$
$\qquad$

- Key Concept and Vocabulary


$4^{1}=4$



## Application Example

6. How many small cubes are in the stack?

$$
\begin{aligned}
3^{3} & =3 \cdot 3 \cdot 3 \\
& =27
\end{aligned}
$$


$\therefore 27$ small cubes are in the stack.
5. $9^{5}=9 \cdot 9 \cdot 9 \cdot 9 \cdot 9=59,049$

## PRACTICE makes PURR-FECT ${ }^{\text {m" }}$

Find the value.
7. $3^{4}=\underline{81}$
8. $4^{5}=\underline{1024}$
9. $12^{3}=\underline{1728}$
10. $18^{1}=$ 18
11. $5^{6}=\underline{15,625}$
12. $2^{10}=\underline{1024}$
13. $8^{2}=64$
14. $7^{3}=343$

## Use an exponent to rewrite the expression.

15. $4 \cdot 4 \cdot 4 \cdot 4=$ $\qquad$
16. $5 \cdot 5 \cdot 5=5^{3}$

How many small cubes are in the stack?
19.
 $\underline{2}^{3}=8$ small
cubes are in
the stack.
16. $1 \cdot 1 \cdot 1=11^{3}$
18. $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3=$ $\qquad$ $3^{5}$
20.


$$
4^{3}=64 \text { small }
$$ cubes are in the stack.

21. FLYING SAUCERS You saw 5 flying saucers. Each flying saucer had 5 aliens. Each alien had 5 eyes. How many alien eyes were there altogether? Explain your reasoning. 125 alien eyes; $5^{3}=5 \cdot 5 \cdot 5=125$
$\qquad$

## Key Concept and Vocabulary

## "Please Excuse My Dear Aunt Sally"

Simplify $4^{2} \div 2+3(9-5)$.
1st Parentheses
2nd Exponents
3rd Multiplication and Division (from left to right)
4th Addition and Subtraction (from left to right)

$$
\begin{aligned}
4^{2} \div 2+3(9-5) & =4^{2} \div 2+3 \cdot 4 \\
& =16 \div 2+3 \cdot 4 \\
& =8+12 \\
& =20
\end{aligned}
$$

## Application Example

6. At a museum, 4 adults pay $\$ 5$ each and 6 children pay $\$ 3$ each. What is the total cost of the tickets?

$$
\begin{align*}
4 \cdot 5+6 \cdot 3 & =20+18 \\
& =38
\end{align*}
$$

4. $20 \div 10+21 \cdot 5=2+105=107$
5. $(2+3)^{2}-5=25-5=20$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$


$\because$ The total cost is $\$ 38$.

## Simplify.

7. $3^{2}+5(4-2)=19$
8. $3+4 \div 2=$ $\qquad$
9. $10 \div 5 \cdot 3=$ $\qquad$
10. $4\left(3^{3}-8\right) \div 2=\underline{38}$
11. $3 \cdot 6-4 \div 2=\underline{16}$
12. $12+7 \cdot 3-24=$ $\qquad$

Insert parentheses to make the statement true.
13. $\left(5^{2}-15\right) \div 5=2$
14. $12 \cdot\left(2^{3}+4\right)=144$
15. $(91-21) \div 7=10$

## Write an expression for the total area of the two rectangles. Evaluate your expression.

16. 


$3 \cdot 4+5^{2} ; 37$
17.

$3^{2}+4 \cdot 6 ; 33$
18. ADMISSION At a baseball game, 6 adults pay $\$ 20$ each and 4 children pay $\$ 10$ each. What is the total cost of the tickets? $\qquad$ \$160
19. INSERTING PARENTHESES Insert parentheses in the expression $4+2^{3}-5 \cdot 2$ in two ways: (a) so that the value is 10 and (b) so that the value is 14 .
(a) $\qquad$
(b)
$\qquad$
$\qquad$

Key Concept and Vocabulary
The greatest common factor (GCF) of two or more positive monomials is the product of their common prime factors.
Prime factorization:
$165=3 \cdot 5 \cdot 11$
$210=2 \cdot 3 \cdot 5 \cdot 7$
The GCF of 165 and 210
is $3 \cdot 5=15$.


Visual Model

$\mathrm{GCF}=2 \cdot 3 \cdot 6$

## Skill Examples

1. $15=3 \cdot 5$
$30=2 \cdot 3 \cdot 5$
$\mathrm{GCF}=3 \cdot 5=15$
2. $20=2 \cdot 2 \cdot 5$
$28=2 \cdot 2 \cdot 7$
$\mathrm{GCF}=2 \cdot 2=4$
3. $48=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$
$90=2 \cdot 3 \cdot 3 \cdot 5$
GCF $=2 \cdot 3=6$
4. $18 x^{3}=2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$
$21 x^{2}=3 \cdot 7 \cdot x \cdot x$
$\mathrm{GCF}=3 \cdot x \cdot x=3 x^{2}$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Application Example

5. You have 48 red flowers, 60 yellow flowers, and 84 white flowers. You want to make flower arrangements that have the same number of each color. What is the greatest number of arrangements that you can make if every flower is used?

$$
\left.\begin{array}{l}
48=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \\
60=2 \cdot 2 \cdot 3 \cdot 5 \\
84=2 \cdot 2 \cdot 3 \cdot 7
\end{array}\right\} \quad \begin{aligned}
& \text { GCF }=2 \cdot 2 \cdot 3 \\
&=12
\end{aligned}
$$

$\because \quad$ You can make 12 arrangements.

Find the greatest common factor.
6. $36=2 \cdot 2 \cdot 3 \cdot 3$
$45=\underline{3 \cdot 3 \cdot 5}$
8. $42=\frac{2 \cdot 3 \cdot 7}{105=3 \cdot 5}$

$$
\mathrm{GCF}=9
$$

7. $70=2 \cdot 5 \cdot 7$

GCF $=$ $\qquad$
$98=\underline{2 \cdot 7 \cdot 7}$
9. $\begin{aligned} 154 & =2 \cdot \frac{2 \cdot 7 \cdot 11}{3 \cdot 7 \cdot 11} \\ 231 & =\frac{3 \cdot 2 \cdot 2 \cdot 7 \cdot}{}\end{aligned}$

GCF $=\underline{77}$
$105=\underline{3 \cdot 5 \cdot 7}$
$\mathrm{GCF}=\underline{21}$
$\begin{aligned} & \text { 10. } 27 y=\underline{3 \cdot 3 \cdot 3 \cdot y} \\ & 54 y^{3}=\underline{2 \cdot 3 \cdot 3 \cdot 3 \cdot y \cdot y} \cdot y\end{aligned} \quad \mathrm{GCF}=\underline{27 y}$
11. $56 m^{5}=\underline{m \cdot m \cdot m \cdot m \cdot m \quad \text { GCF }=\underline{4 m^{4}}}$
$68 m^{4}=\underline{2 \cdot 2 \cdot 17 \cdot m \cdot m \cdot m} \cdot m$
12. CLOTH You have two pieces of cloth. One piece is 80 inches wide and the other is 96 inches wide. You want to cut both pieces into strips of equal width that are as wide as possible. How wide should you cut each strip? $\quad$ width $=\underline{16 \text { inches }}$
$\qquad$

## Multiple

## Key Concept and Vocabulary

The least common multiple (LCM) of two or more positive monomials is the product of their factors, using each common prime factor only once.
Prime factorization:

$$
\begin{aligned}
& 30=2 \cdot 3 \cdot 5 \\
& 42=2 \cdot 3 \cdot 7
\end{aligned}
$$

The LCM of 30 and 42 is $2 \cdot 3 \cdot 5 \cdot 7=210$.


Visual Model


$$
\mathrm{LCM}=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5=720
$$

## Skill Examples

1. $15=3 \cdot 5$
$30=2 \cdot 3 \cdot 5$
$\mathrm{LCM}=2 \cdot 3 \cdot 5=30$
2. $20=2 \cdot 2 \cdot 5$
$28=2 \cdot 2 \cdot 7$
$\mathrm{LCM}=2 \cdot 2 \cdot 5 \cdot 7=140$
3. $48=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3$
$90=2 \cdot 3 \cdot 3 \cdot 5$
LCM $=2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5=720$
4. $18 x^{3}=2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x$
$21 x^{2}=3 \cdot 7 \cdot x \cdot x$
LCM $=2 \cdot 3 \cdot 3 \cdot 7 \cdot x \cdot x \cdot x=126 x^{3}$

## Application Example

5. Hot dogs come in packages of 10 and hot dog buns come in packages of 8 . What is the least number of packages of each that you need to buy to have the same number of hot dogs and hot dog buns?
$\left.\begin{array}{l}10=2 \cdot 5 \\ 8=2 \cdot 2 \cdot 2\end{array}\right\} \quad \begin{aligned} \mathrm{LCM} & =2 \cdot 2 \cdot 2 \cdot 5 \\ & =40\end{aligned}$
$40 \div 10=4$ packages of hot dogs $40 \div 8=5$ packages of hot dog buns
$\because \quad$ You must buy 4 packages of hot dogs and 5 packages of hot dog buns.

## PRACTICE MAKES PURR-FECT ${ }^{\text {тм }}$



Check your answers at BigIdeasMath.com.
Find the least common multiple.
6. $\begin{aligned} 36 & =\underline{2 \cdot 2 \cdot 3 \cdot 3} \\ 45 & =\underline{3 \cdot 3 \cdot 5}\end{aligned}$ $\mathrm{LCM}=\underline{180}$
8. $42=\underline{2 \cdot 3 \cdot 7}$ $\operatorname{LCM}=\underline{210}$
$105=\underline{3 \cdot 5 \cdot 7}$
10. $27 y=\underline{3 \cdot 3 \cdot 3 \cdot y}$ $\mathrm{LCM}=\underline{54 y^{3}}$ $54 y^{3}=\underline{2 \cdot 3 \cdot 3 \cdot 3 \cdot y \cdot y \cdot y}$
7. $70=\underline{2 \cdot 5 \cdot 7}$
$98=\underline{2 \cdot 7 \cdot 7}$
$\mathrm{LCM}=\underline{490}$
9. $154=\underline{2 \cdot 7 \cdot 11} \quad \mathrm{LCM}=\underline{462}$
$231=\frac{3 \cdot 7 \cdot 11}{2 \cdot 2 \cdot 2 \cdot 7 \cdot m}$
11. $56 m^{5}=\quad \mathrm{LCM}=\underline{952 m^{5}}$
$68 m^{4}=\underline{2 \cdot 2 \cdot 17 \cdot m} \cdot m \cdot m \cdot m$
12. BOXES Boxes that are 12 inches tall are being stacked next to boxes that are 18 inches tall. What is the shortest height at which the two stacks will be the same height? height $=36$ inches

REVIEW: Multiplying Fractions


Name $\qquad$

## Visual Model



## Skill Examples

1. $\frac{2}{3} \cdot \frac{1}{4}=\frac{2 \cdot 1}{3 \cdot 4}=\frac{2}{12}=\frac{1}{6}$
2. $\frac{3}{8} \times \frac{2}{9}=\frac{3 \cdot 2}{8 \cdot 9}=\frac{6}{72}=\frac{1}{12}$
3. $\left(\frac{2}{5}\right)\left(\frac{1}{4}\right)=\frac{2 \cdot 1}{5 \cdot 4}=\frac{2}{20}=\frac{1}{10}$
4. $\frac{1}{7} \cdot \frac{3}{5}=\frac{1 \cdot 3}{7 \cdot 5}=\frac{3}{35}$

## Application Example

5. A recipe calls for three-fourths cup of flour. You want to make one-half of the recipe.
How much flour should you use?

$$
\frac{1}{2} \cdot \frac{3}{4}=\frac{1 \cdot 3}{2 \cdot 4}=\frac{3}{8}
$$

$\therefore$ You should use $\frac{3}{8}$ cup flour.

## PRACTICE maKes PURR-FECT ${ }^{\text {™ }}$

Find the product. Write your answer in simplified form.
6. $\frac{1}{3} \cdot \frac{2}{7}=\underline{\frac{2}{21}}$
7. $\frac{1}{2} \times \frac{1}{4}=\underline{\frac{1}{8}}$
8. $\frac{1}{10} \cdot \frac{3}{10}=\frac{\frac{3}{100}}{}$
9. $\frac{3}{2} \times \frac{2}{5}=\underline{\frac{3}{5}}$
10. $\frac{3}{8} \times \frac{1}{2}=\underline{\frac{3}{16}}$
11. $\left(\frac{1}{5}\right)\left(\frac{2}{5}\right)=\underline{\frac{2}{25}}$
12. $\left(\frac{2}{3}\right)^{2}=\underline{\frac{4}{9}}$
13. $\frac{3}{2} \cdot \frac{2}{3}=\underline{1}$
14. $\left(\frac{3}{1}\right)\left(\frac{1}{3}\right)=-1$
15. $2 \cdot \frac{1}{4}=\underline{\frac{1}{2}}$
16. $3 \times \frac{3}{4}=2 \frac{1}{4}$
17. $\frac{1}{3} \cdot \frac{3}{4} \cdot \frac{4}{5}=\underline{\frac{1}{5}}$

Find the area of the rectangle or parallelogram.
18.


Area $=\underline{\frac{1}{4} \mathrm{ft}^{2}}$
19.


$$
\text { Area }=\underline{\frac{3}{20}} \mathrm{~cm}^{2}
$$

20. 



Area $=\underline{\frac{15}{64} \mathrm{in} .^{2}}$
21.


Area $=\underline{\frac{6}{25} \mathrm{~m}^{2}}$
22. OPEN-ENDED Find three different pairs of fractions that have the same product.


REVIEW: Multiplying Mixed Numbers Name $\qquad$


## Skill Examples

1. $3 \frac{1}{2} \times 2 \frac{1}{3}=\frac{7}{2} \times \frac{7}{3}=\frac{49}{6}=8 \frac{1}{6}$
2. $1 \frac{3}{4} \cdot 4 \frac{1}{2}=\frac{7}{4} \cdot \frac{9}{2}=\frac{63}{8}=7 \frac{7}{8}$
3. $2 \frac{2}{5} \times 1 \frac{2}{3}=\frac{12}{5} \times \frac{5}{3}=\frac{60}{15}=4$
4. $\left(1 \frac{1}{2}\right)\left(1 \frac{1}{2}\right)=\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)=\frac{9}{4}=2 \frac{1}{4}$

## Visual Model



$$
\text { Area }=2 \frac{1}{2} \times 1 \frac{1}{2}=\frac{15}{4}=3 \frac{3}{4}
$$

## Application Example

5. Find the area of the triangle.

$$
\begin{aligned}
\text { Area } & =\frac{1}{2} \cdot 1 \frac{1}{2} \cdot 3 \\
& =\frac{1}{2} \cdot \frac{3}{2} \cdot \frac{3}{1}=\frac{9}{4}=2 \frac{1}{4}
\end{aligned}
$$



## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Find the product. Write your answer as a whole number or mixed number in simplified form.
6. $2 \frac{1}{3} \times 1 \frac{1}{3}=\underline{3 \frac{1}{9}}$
7. $4 \frac{2}{3} \times 1 \frac{1}{2}=$ $\qquad$ 8. $1 \frac{1}{2} \times 3=\underline{4 \frac{1}{2}}$
9. $5 \frac{1}{6} \times \frac{1}{3}=\frac{1 \frac{13}{18}}{3}$
10. $\frac{3}{4} \cdot 3 \frac{1}{2}=\underline{2 \frac{5}{8}}$
11. $5 \cdot 4 \frac{1}{2}=22 \frac{1}{2}$
14. $\left(1 \frac{1}{3}\right)^{2}=\underline{1 \frac{7}{9}}$
15. $\left(1 \frac{1}{4}\right)^{3}=\underline{1 \frac{61}{64}}$
12. $2 \frac{1}{7} \cdot \frac{7}{15}=$ $\qquad$
13. $1 \frac{3}{5} \cdot \frac{3}{8}=$ $\qquad$
16. $\left(2 \frac{1}{2}\right)\left(3 \frac{1}{3}\right)=\underline{8 \frac{1}{3}}$
17. $\left(3 \frac{1}{2}\right)\left(\frac{1}{2}\right)^{2}=\underline{\frac{7}{8}}$

## Find the area of the triangle.

18. 


19.


Area $=\underline{5 \frac{1}{3} \mathrm{~cm}^{2}}$
20. RECIPE Rewrite the recipe so that each item is one-third of the full recipe.

| $2-1$ |
| :--- |
| 2 |
| 2 |
| 2 tsp baks flour |
| 4 Tbsp butter |
| $\frac{1}{2}$ tsp salt |
| 2 |
| $\frac{3}{4}$ cup milk |


$\qquad$


## Visual Model

There are 2 "one-thirds" in two-thirds.

$$
\frac{2}{3} \div \frac{1}{3}=\frac{2}{3} \cdot \frac{3}{1}=2
$$

| $\frac{1}{3}$ | $\frac{1}{3}$ |  |
| :---: | :---: | :--- |

## Skill Examples

1. $\frac{2}{5} \div \frac{1}{5}=\frac{2}{5} \cdot \frac{5}{1}=\frac{2 \cdot 5}{5 \cdot 1}=2$
2. $\frac{2}{5} \div 5=\frac{2}{5} \cdot \frac{1}{5}=\frac{2 \cdot 1}{5 \cdot 5}=\frac{2}{25}$
3. $\frac{9}{4} \div \frac{3}{4}=\frac{9}{4} \cdot \frac{4}{3}=\frac{9 \cdot 4}{4 \cdot 3}=3$

## Application Example

5. You drive 25 miles in one-half hour. What is your average rate?

$$
25 \div \frac{1}{2}=\frac{25}{1} \cdot \frac{2}{1}=50 \mathrm{mi} / \mathrm{h} \quad r=\frac{d}{t}
$$

$\therefore$ Your average rate is 50 miles per hour.
4. $6 \div \frac{1}{2}=\frac{6}{1} \cdot \frac{2}{1}=\frac{6 \cdot 2}{1 \cdot 1}=12$

## PRACTICE makes PURR-FECT ${ }^{\text {TM }}$

Find the quotient. Write your answer in simplified form.
6. $\frac{3}{5} \div \frac{1}{5}=\underline{3}$
7. $4 \div \frac{1}{2}=$ $\qquad$
8. $\frac{2}{3} \div \frac{1}{6}=$ $\qquad$
9. $\frac{1}{6} \div \frac{2}{3}=$ $\qquad$
10. $\frac{2}{3} \div 2=$ $\qquad$
11. $\frac{3}{4} \div 4=$ $\qquad$
12. $\frac{3}{7} \div \frac{3}{7}=$ $\qquad$
13. $\frac{3}{7} \div \frac{7}{3}=$ $\qquad$
14. $5 \div \frac{1}{2}=\underline{10}$
15. $\frac{9}{4} \div \frac{1}{4}=$ $\qquad$
16. $\frac{1}{4} \div \frac{1}{2}=$ $\qquad$
17. $\frac{3}{11} \div 11=$ $\qquad$

Find the height of the rectangle or parallelogram.
18.


Area $=\frac{1}{4} \mathrm{ft}^{2}$
19.


Area $=\frac{2}{25} \mathrm{~cm}^{2}$
20.


Area $=\frac{3}{16} \mathrm{in} .{ }^{2}$
21.


Area $=\frac{1}{50} \mathrm{~m}^{2}$
22. SPEED You drive 15 miles in one-fourth hour. What is your average speed? $60 \mathrm{mi} / \mathrm{h}$
23. MAGNETIC TAPE A refrigerator magnet uses $\frac{5}{8}$ inch of magnetic tape. How many refrigerator magnets can you make with 10 inches of magnetic tape? Explain.

REVIEW: Dividing Mixed Numbers

## -Key Concepł and Vocabulary

## Rewrite as improper fractions. <br> $$
2 \frac{1}{2} \div 5=\frac{5}{2} \div \frac{5}{1}
$$ <br> $$
=\frac{5}{2} \times \frac{1}{5}
$$ <br> $$
=\frac{1}{2}
$$

Name

## Visual Model

Divide $2 \frac{1}{2}$ into five equal parts. Each part is $\frac{1}{2}$.

$$
2 \frac{1}{2} \div 5=\frac{1}{2}
$$



## Application Example

5. You need $2 \frac{1}{2}$ inches of ribbon to make a Blue-Ribbon award. How many awards can you make with 35 inches of ribbon?

$$
35 \div 2 \frac{1}{2}=\frac{35}{1} \div \frac{5}{2}=\frac{35}{1} \times \frac{2}{5}=14
$$

¿- You can make 14 awards.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Find the quotient. Write your answer as a whole or mixed number in simplest form.
6. $4 \frac{1}{2} \div 9=$ $\qquad$
7. $3 \frac{3}{7} \div 8=$ $\qquad$
8. $4 \frac{2}{3} \div 7=$ $\qquad$ 9. $1 \frac{7}{9} \div 4=$ $\qquad$
10. $8 \div 1 \frac{1}{3}=$ $\qquad$ 11. $32 \div 3 \frac{1}{5}=$ $\qquad$ 12. $11 \div 2 \frac{3}{4}=$ $\qquad$ 13. $9 \div 1 \frac{1}{2}=$ $\qquad$
14. $5 \frac{1}{2} \div \frac{1}{2}=$ $\qquad$ 15. $\frac{1}{2} \div 1 \frac{1}{2}=$
16. $1 \frac{1}{4} \div 1 \frac{1}{4}=$ $\qquad$ 17. $3 \frac{1}{2} \div 1 \frac{1}{3}=$ $\qquad$

## Find the missing dimension.

18. 


$\qquad$ ft
19.

20. RED RIBBONS You need $3 \frac{1}{2}$ inches of ribbon to make a Red-Ribbon award. How many awards can you make with 35 inches of ribbon? $\qquad$
21. SHIPPING You are stacking books into a shipping box that is 15 inches high. Each book is $1 \frac{1}{4}$ inches thick. How many books can you fit in a stack? $\qquad$
$\qquad$ Decimals


Skill Examples

1. 134.12
$\begin{array}{r}+25.485 \\ \hline 159.605\end{array}$
2. 0.135
$\begin{array}{r}+0.14 \\ \hline 0.275\end{array}$

## Visual Model



## Application Example

5. Find the perimeter of the triangle.

$$
2.1+1.7+3.4=7.2
$$


$\because$ The perimeter is 7.2 inches.

## PRACTICE MAKES PURR-FECT ${ }^{\text {™ }}$

## Find the sum or difference.

6. $4.75+3.56=\underline{8.31}$
7. $9.0-1.507=\underline{7.493}$
8. $2.4+2.04=4.44$
9. $112.5+24.52=\underline{137.02}$
10. $5.7-4.81=\underline{0.89}$
11. $20-12.5=\underline{7.5}$
12. $2.3+3.4+5.9=$ $\qquad$ 11.6 13. $3.4+5.6-2.3=\underline{6.7}$
13. $10.0-(4.5+2.3)=$ $\qquad$ 3.2

Find the perimeter of the triangle.
15.

16.

17. SHOPPING You take $\$ 20$ to the store. You buy a magazine for $\$ 3.65$ and a birthday card for $\$ 5.29$. How much money do you have left? $\qquad$ \$11.06
18. NUMBER LINE Show the sum graphically on the number line: $1.75+3.5$.


REVIEW: Multiplying Decimals
Name $\qquad$

## Visual Model



Area $=2.5 \times 1.5=3.75$

## Application Example

4. Find the area of the rectangle.
$2.4 \times 4.1=9.84$
4.1 ft

| 1. 43.8 | 2. 0.327 | 3. 32.5 |
| :---: | :---: | :---: |
| $\times 1.5$ | +24 | $\times 1.13$ |
| 2190 | 1308 | 975 |
| 438 | 654 | 325 |
| 65.70 | 7.848 | 325 |
|  |  | 36.725 |

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$



Find the product.
5. $3.02 \times 5.2=\underline{15.704}$
6. $1.75 \times 1=\underline{1.75}$
7. $(9.004)(0)=\underline{0}$
8. $(4.05)^{2}=\underline{16.4025}$
9. $2.25 \times 4=$ $\qquad$
10. $(100.5)(90)=\underline{9045}$
11. $19.4 \times 5.05=\underline{97.97}$
12. $(1.2)(1.3)(1.4)=\underline{2.184}$
13. $115 \times 3.2=\underline{368}$
14. $16(0.375)=\underline{6}$
15. $(2.347)(1.8)=\underline{4.2246}$
16. $(1.5)^{3}=\underline{3.375}$

## Find the area of the rectangle.

17. 



$$
\text { Area }=\quad 27.95 \mathrm{~cm}^{2}
$$

18. 



$$
\text { Area }=\underline{145.08} \text { in. }^{2}
$$

19. APPLES Apples cost $\$ 3.45$ per pound. Find the cost of 2.6 pounds of apples. $\qquad$
4.29
20. PEACHES Peaches cost $\$ 4.29$ per pound. Find the cost of two and a quarter pounds of peaches. Show your work. $\qquad$ 2.25

REVIEW: Dividing Decimals
Name $\qquad$
Visual Model

$$
12.5 \div 5=2.5
$$



When you divide 12.5 into 5 equal parts, each part will be 2.5.

## Skill Examples

1. $65.3 \div 10=6.53$
2. $65.3 \div 100=0.653$

Divide by a power of 10 by moving the decimal point.
3. $65.3 \div 1000=0.0653$
4. $65.3 \div 10,000=0.00653$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Application Example

5. A prize of $\$ 104.32$ is divided equally among four people. How much does each person get?

$$
104.32 \div 4=26.08
$$

## Find the quotient.

6. $5.2 \div 10=\underline{0.52}$
7. $73.1 \div 100=\underline{0.731}$
8. $1500 \div 1000=$ $\qquad$
9. $18.98 \div 3.65=$ $\qquad$
10. $0.598 \div 2=\underline{0.299}$
11. $19.003 \div 1=\underline{19.003}$
12. $3.42 \div 0.36=\underline{9.5}$
13. $78.4 \div 1.4=$ $\qquad$
14. $1000 \div 12.5=$ $\qquad$
15. $0.45 \div 0.0125=$ $\qquad$ 16. $29.45 \div 4.75=$ $\qquad$ 17. $19.7 \div 0.1=$ $\qquad$

Find the width of the rectangle.
18.

19.
8.5 in .

20. DRIVING TRIP You drive 1400 miles in 3.5 days. What is the average number of miles you drive per day? $\qquad$
21. METRIC SYSTEM There are 2.54 centimeters in one inch. How many inches are there in 51.78 centimeters? Round your answer to the nearest tenth of an inch. $\qquad$

REVIEW: Ratios


Name $\qquad$

## Visual Model



## Application Example

4. Write the ratio of basketballs to soccer balls in three ways.

There are 4 basketballs. There are 5 soccer balls.
$\because \frac{4}{5}, 4$ to 5 , and $4: 5$

## PRACTICE makes PURR-FECT ${ }^{\text {TM }}$



Write the simplified ratio of green objects to blue objects in three ways.


## Write the simplified ratio of blue objects to all objects in three ways.

9. Frogs in Exercise $5 \frac{1}{2}, 1$ to $2,1: 2$
10. Cars in Exericise $7 \frac{1}{3}, 1$ to $3,1: 3$
11. Balloons in Exercise $6 \frac{1}{3}, 1$ to $3,1: 3$
12. Flowers in Exercise 8 $\frac{3}{7}, 3$ to $7,3: 7$
13. CLASS RATIO The ratio of boys to girls in a class is 5 to 4 . There are 12 girls in the class. How many boys are in the class? $\qquad$

Name $\qquad$


## Skill Examples

1. You drive 100 miles in 2 hours.

Your unit rate is 50 miles per hour.
2. You earn $\$ 40$ in 5 hours.

Your unit rate is $\$ 8$ per hour.
3. You save $\$ 240$ in 6 months.

Your unit rate is $\$ 40$ per month.

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$

## Application Example

4. Janice was 44 inches tall when she was

8 years old. She was 52 inches tall when she was 12 years old. What was her unit rate?

She grew 8 inches in 4 years: $\frac{8}{4}=\frac{2}{1}$.
Visual Model


Check your answers at BigIdeasMath.com.

Write the unit rate in words and as a fraction for each situation.
5. You fly 2000 miles in 4 hours.
6. You pay 15 dollars for 3 pizzas.
$\frac{500 \text { miles per hour }}{\text { Words }}$
$\frac{\frac{500 \mathrm{mi}}{1 \mathrm{~h}}}{\frac{\$ 5^{\text {Fraction }}}{1 \text { pizza }}}$

Fraction
Words
$\frac{0.08 \text { dollar per } 1 \text { dollar purchase }}{\text { Words }}$
5 dollars per pizza
7. You pay $\$ 4$ sales tax on a $\$ 50$ purchase.
8. You earn $\$ 25$ for mowing 5 lawns.

5 dollars per lawn
Words
\$0.08
\$1 purchase


Fraction

## Circle the name of the person with the greater unit rate.

9. Maria saves $\$ 50$ in 4 months.

Ralph saves $\$ 60$ in 5 months.
11. Kim earns $\$ 400$ for working 40 hours. Samearns $\$ 540$ for working 45 hours.

## Convert the unit rate.

13. $\frac{60 \text { miles }}{1 \text { hour }}=\frac{88 \text { feet }}{1 \text { second }}$
14. John rides his bicycle 36 miles in 3 hours.

Randy rides his bicycle 30 miles in 2.5 hours. Unit rates are the same.
12. Arlene scores 450 points on 5 tests.

Jolene scores 180 points on 2 tests.
Unit rates are the same.

REVIEW: Direct Variation


Name $\qquad$

## Visual Model

For positive values of $x$ and $y$, as $x$ increases, $y$ increases.

$$
y=\frac{1}{2} x
$$



## Skill Example

1. Equation: $y=2 x$

Table:

| $\boldsymbol{x}$ | 0 | 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 2 | 4 | 6 | 8 | 10 |

Words: $y$ is twice the value of $x$.

## Application Example

2. The amount $y$ of gasoline a car uses is $\frac{1}{20}$ times the number $x$ of miles it travels. Make a table to show this relationship.

| $\boldsymbol{x}$ | 0 | 20 | 40 | 60 | 80 | 100 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 1 | 2 | 3 | 4 | 5 |

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Check your answers at BigIdeasMath.com.
Complete the table. Then sketch the graph.
3. $y=1.5 x$

| $x$ | $y$ |
| :---: | :---: |
| 0 | 0 |
| 1 | 1.5 |
| 2 | 3 |
| 3 | 4.5 |
| 4 | 6 |

4. $y=\frac{2}{3} x$

| $\boldsymbol{x}$ | $\boldsymbol{y}$ |
| :---: | :---: |
| 0 | 0 |
| 1 | $\frac{2}{3}$ |
| 2 | $\frac{4}{3}$ |
| 3 | 2 |
| 4 | $\frac{8}{3}$ |



WRITING AN EQUATION Write a direct variation equation for the table.
5.

| $x$ | 0 | 1 | 2 | 3 | 4 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 3 | 6 | 9 | 12 | $y=3 x$ |

6. 

| $\boldsymbol{x}$ | 0 | 1 | 2 | 3 | 4 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\boldsymbol{y}$ | 0 | 0.4 | 0.8 | 1.2 | 1.6 |

$$
y=0.4 x
$$

7. WALRUS The amount $y$ that a walrus eats is directly proportional to its weight $x$. A 4000 pound walrus eats 20 pounds each day. How much does a 2000 pound walrus eat each day? $\qquad$

REVIEW: Proportions


Name $\qquad$

## Application Example

4. You spend $\$ 5$ for 3 tennis balls. Your friend spends $\$ 6.25$ for 4 tennis balls. Are the two rates proportional?

## Visual Model

The ratio " 2 to 3 " is equal to the ratio " 4 to 6 ."


$$
\frac{\$ 5}{3 \text { balls }} \stackrel{?}{=} \frac{\$ 6.25}{4 \text { balls }} \quad 5(4) \neq 3(6.25)
$$

$\because$ The rates are not proportional.

## Skill Examples

1. $\frac{3}{5}=\frac{12}{20} \quad$ is a proportion because the cross products are equal.
2. $\frac{1}{7}=\frac{7}{48}$ is not a proportion because the cross products are not equal.
3. $\frac{10}{2}=\frac{5}{1}$
is a proportion because the cross products are equal.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Decide whether the statement is a proportion.
5. $\frac{3}{7}=\frac{6}{14}$
proportion
6. $\frac{1}{4}=\frac{4}{1}$
not a proportion
7. $\frac{3}{2}=\frac{9}{4} \quad$ not a proportion
8. $\frac{1.25}{3}=\frac{5}{12} \quad$ proportion
9. $\frac{6}{18}=\frac{120}{360} \quad$ proportion
10. $\frac{4}{5}=\frac{4+4}{5+5}$
proportion

## Complete the proportion.

11. $\frac{2}{5}=\frac{4}{10}$
12. $\frac{1}{6}=\frac{4}{24}$
13. $\frac{3}{8}=\frac{9}{24}$

Write the proportion that compares the circumference to the radii of the two circles.
14.


Sample
$\frac{4 \pi}{6 \pi}=\frac{2}{3}$
15.

$\square \quad \frac{8 \pi}{10 \pi}=\frac{4}{5}$
16. COMPARING RATES You spend $\$ 20$ for 5 T -shirts. Your friend spends $\$ 15$ for 3 T -shirts.

Are the two rates proportional? $\qquad$
$\qquad$

## Systems With Benchmarks



## Visual Model


$1 \mathrm{in} . \approx 3 \mathrm{~cm}$

## Skill Examples

1. $7 \mathrm{~m} \approx 7 \mathrm{mt} \cdot \frac{3 \mathrm{ft}}{1 \mathrm{~m}}=21 \mathrm{ft}$
2. $20 \mathrm{~L} \approx 20 \mathrm{~K} \cdot \frac{1 \mathrm{gal}}{4 \mathrm{Z}}=5 \mathrm{gal}$
3. $8 \mathrm{oz} \approx 8 \mathrm{gz} \cdot \frac{30 \mathrm{~g}}{1 \rho \mathrm{Z}}=240 \mathrm{~g}$
4. $2 \mathrm{c} \approx 2 \not \subset \cdot \frac{200 \mathrm{~mL}}{1 \not \chi^{\prime}}=400 \mathrm{~mL}$

## Application Example

5. A person is 63 inches tall. How many centimeters is that?

$$
63 \mathrm{in} . \approx 63 \mathrm{in} . \cdot \frac{3 \mathrm{~cm}}{1 \mathrm{inn}}
$$

$$
=189 \mathrm{~cm}
$$

$\because \quad$ The height of the person is about 189 centimeters.

## PRACTICE MAKES PURR-FECT ${ }^{\text {m }}$

## Complete the unit conversion.

6. $26 \mathrm{mi} \approx$ $\qquad$ km
7. $150 \mathrm{~g} \approx$ $\qquad$ oz
8. $2 \mathrm{~L} \approx$ $\qquad$ qt
9. $70 \mathrm{lb} \approx$ $\qquad$ kg
10. $12 \mathrm{ft} \approx$ $\qquad$ m
11. $16 \mathrm{~km} \approx$ $\qquad$ mi
12. $36 \mathrm{~cm} \approx$ $\qquad$ 12 in.
13. $7 \mathrm{gal} \approx$ $\qquad$ L
14. $9 \mathrm{qt} \approx$ $\qquad$ L
15. $800 \mathrm{~mL} \approx$ $\qquad$ c
16. $5 \mathrm{gal} \approx \underline{20,000} \mathrm{~cm}^{3}$
17. $12 \mathrm{~m}^{3} \approx$ $\qquad$ gal
18. WEIGHT How much does the wolf weigh in pounds? about 66 pounds


Weight: 33 kg
19. SPEED A hummingbird flies at a speed of 33 feet per second. What is the speed of the hummingbird in meters per second? about 11 meters per second


REVIEW: Fractions and Decimals
Name $\qquad$

## Skill Examples

1. $0.6=\frac{6}{10}=\frac{3}{5}$
2. $\frac{4}{5}=\frac{4 \cdot 2}{5 \cdot 2}=\frac{8}{10}=0.8$
3. $0.875=\frac{875}{1000}=\frac{7 \cdot 125}{8 \cdot 125}=\frac{7}{8}$

Visual Model $\frac{1}{4}=0.25$


## Application Example

5. You put 16.75 gallons of gas in your car.

Write this decimal as a mixed number.

$$
16.75=16+0.75=16 \frac{3}{4}
$$

4. $\frac{1}{3}=0.333 \ldots=0 . \overline{3}$
31.0000...

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Write the fraction as a decimal.
6. $\frac{3}{4}=\underline{0.75}$
7. $\frac{7}{10}=\underline{0.7}$
8. $\frac{3}{25}=\underline{0.12}$
9. $\frac{7}{20}=\underline{0.35}$
10. $\frac{19}{100}=\underline{0.19}$
11. $\frac{11}{50}=\underline{0.22}$
12. $\frac{2}{3}=\underline{0 . \overline{6}}$
13. $\frac{1}{6}=\underline{0.1 \overline{6}}$

## Write the decimal as a fraction.

14. $0.4=$ $\qquad$ 15. $0.35=\underline{\frac{7}{20}}$
15. $0.6=\underline{\frac{3}{5}}$
16. $1.5=\underline{\frac{3}{2}}$

Write the number represented by the model as a decimal and as a simplified fraction.
18.

19. $\underline{0.45}=\underline{\frac{5}{20}}$

20. $0.88=\underline{\frac{22}{25}}$

21. GAS You put 9.25 gallons of gas in your car. Write this decimal as a mixed number. $\qquad$
22. MULTIPLE FORMS Write the decimal 0.35 in two ways. One with a denominator of 100 and one with a denominator of 1000 . $\qquad$ $\frac{35}{100} ; \frac{350}{1000}$

REVIEW: Percents and Fractions
Name $\qquad$
Key Concept and Vocabulary

$$
35 \%=\frac{35}{100}=\frac{5 \cdot 7}{5 \cdot 20}=\frac{7}{20}
$$

Write percent as a fraction in simplest form.

Visual Model $\quad 35 \%=\frac{7}{20}$


## Application Example

5. Your school's softball team won $30 \%$ of its games. Did the team win more than one-fourth of its games?

$$
30 \%=\frac{3}{10} \quad \frac{3}{10}>\frac{1}{4}
$$

$\because$ Yes, the team won more than one-fourth of its games.

## PRACTICE makes PURR-FECT

## Write the percent as a fraction in simplest form.

6. $20 \%=$ $\qquad$ $\frac{1}{5}$
7. $45 \%=$ $\qquad$ $\frac{9}{20}$
8. $7 \%=\frac{100}{3}$
9. $32.5 \%=$ $\qquad$
10. $15 \%=$ $\qquad$
11. $1 \%=$ $\qquad$
12. $150 \%=$ $\qquad$
13. $33 \frac{1}{3} \%=$ $\qquad$

## Write the fraction as a percent.

14. $\frac{3}{20}=\underline{15 \%}$
15. $\frac{6}{5}=\underline{120 \%}$
16. $\frac{5}{8}=\underline{62.5 \%}$
17. $\frac{3}{5}=\underline{60 \%}$

Write the fraction represented by the model as a percent.
18.

19.

20.

21. SURVEY Eighteen out of twenty people in a survey said that vanilla ice cream is their favorite flavor of ice cream. What percent is this? $\qquad$ 90\%
22. SPANISH LANGUAGE Twelve of the 40 students in your class can speak Spanish.

What percent is this? $\qquad$ $30 \%$

REVIEW: Percents and Decimals
Name $\qquad$

## Skill Examples

## Visual Model

$$
18 \%=0.18
$$



|  |  | $A$ |  | $\|l\| l \mid$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
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|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

## Application Example

1. $18 \%=0.18$
2. $145 \%=1.45$
3. $0.005=0.5 \%$ (one-half of one percent)
4. What percent of the circle graph is represented by the yellow region?
$0.36=36 \%$

5. $0.125=12.5 \%$

## PRACTICE Makes PURR-FECT ${ }^{\text {m" }}$

Check your answers at BigIdeasMath.com. $\qquad$
Write the percent as a decimal.
6. $20 \%=\underline{0.2}$
7. $45 \%=\underline{0.45}$
8. $7 \%=\underline{0.07}$
9. $32.5 \%=\underline{0.325}$
10. $15 \%=\underline{0.15}$
11. $1 \%=\underline{0.01}$
12. $150 \%=1.5$
13. $0.2 \%=\underline{0.002}$

## Write the decimal as a percent.

14. $0.13=\underline{13 \%}$
15. $1.4=\underline{140 \%}$
16. $0.001=\underline{0.1 \%}$
17. $2.5=\underline{250 \%}$

What percent of the circle graph is represented by the yellow region?
18.

19.

20.

21. BUDGET You have set aside two twenty-fifths of your monthly budget for clothing. What percent is this? $\qquad$ -
22. SUMMER SCHOOL Eighty-seven percent of the students in your class do not plan to attend summer school. What percent of your class plans to attend summer school? $\qquad$ 13\%

REVIEW: Finding the Percent of a Number

Name $\qquad$


## Skill Examples

1. $30 \%$ of $50: ~ 0.3 \times 50=15$
2. $45 \%$ of $80: 0.45 \times 80=36$
3. $110 \%$ of $40: 1.1 \times 40=44$

Visual Model


## Application Example

5. $28 \%$ of the 200 people who answered a survey own a dog. How many of the 200 people in the survey own a dog?
$0.28 \times 200=56$
$\because 56$ of the 200 people own a dog.

## PRACTICE MAKES PURR-FECT ${ }^{\text {TM }}$

Check your answers at BigIdeasMath.com.
Find the percent of the number.
6. $25 \%$ of $40=$ $\qquad$ 7. $20 \%$ of $35=$ $\qquad$ 7
8. $65 \%$ of $110=\underline{71.5}$
9. $125 \%$ of $20=$ $\qquad$
10. $33 \frac{1}{3} \%$ of $60=$ $\qquad$ 11. $95 \%$ of $400=$ $\qquad$ 380
12. $200 \%$ of $31=$ $\qquad$ 62
13. $18 \%$ of $90=$ $\qquad$
14. $1 \%$ of $800=$ $\qquad$ 15. $60 \%$ of $60=$ $\qquad$ 36
16. $100 \%$ of $59=$ $\qquad$ 59 17. $1000 \%$ of $59=\underline{590}$

Write the question represented by the model. Then answer the question.
18.


Question: What is $60 \%$ of 90 ?
Answer: 54

19. | $0 \%$ |
| :---: |

Question: What is $80 \%$ of 120 ?
Answer: 96
20. ENDANGERED SPECIES Sixty percent of a species of butterfly died due to loss of habitat. Originally, there were 10,000 butterflies. How many are left? $\qquad$
21. SALES TAX You buy 4 breakfast sandwiches at $\$ 2.59$ each, 4 hashbrowns at $\$ 1.10$ each, and 4 bottles of orange juice at $\$ 1.25$ each. The sales tax is $6 \%$. Find the total cost of the 4 meals, including sales tax. $\qquad$

REVIEW: Percents and Proportions


## Skill Examples

1. $\frac{36}{50}=\frac{p}{100}$
$100 \cdot \frac{36}{50}=100 \cdot \frac{p}{100}$
$72=p$
$\because \quad$ So, 36 is $72 \%$ of 50 .
2. $\frac{a}{36}=\frac{20}{100}$
$36 \cdot \frac{a}{36}=36 \cdot \frac{20}{100}$

$$
a=7.2
$$

$\because$ So, 7.2 is $20 \%$ of 36 .

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$

Write and solve a proportion to answer the question.
4. 68 is what percent of 80 ?

85\%
6. 36 is $16 \%$ of what number?

$$
225
$$

8. What number is $64 \%$ of 40 ?
25.6
9. What number is $25 \%$ of 116 ?
$\qquad$
29
10. 48 is what percent of 128 ?
37.5\%
11. 77 is $55 \%$ of what number?

140
10. PLAY Students are auditioning for a play. Of the 60 students auditioning, 12 will get a part in the play. What percent of the students who audition will get a part in the play?
$\qquad$
11. HOMEWORK You have completed $60 \%$ of your English homework. The assignment has 25 questions. How many questions are left? $\qquad$ 10

REVIEW: Estimating and Finding a Tip

## Key Concept and Vocabulary

To find the tip on a food bill at a restaurant, write the percent as a decimal or fraction and multiply it by the cost of the food bill.


Name $\qquad$

## Visual Model



## Application Examples

1. Your food bill at a restaurant is $\$ 8.49$. You leave a $15 \%$ tip.
Estimate: Round 8.49 to 10 .

$$
0.15 \times 10=1.5
$$

$\because$ The estimate for the tip is $\$ 1.50$.
Actual: $0.15 \times 8.49 \approx 1.27$
$\therefore$ The actual tip is $\$ 1.27$.
2. Your food bill at a restaurant is $\$ 15.83$. You leave a $20 \%$ tip.
Estimate: Round 15.83 to 16 .
$0.2 \times 16=3.2$
$\therefore$ The estimate for the tip is $\$ 3.20$.
Actual: $0.2 \times 15.83 \approx 3.17$
$\therefore$ The actual tip is $\$ 3.17$.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

Estimate the tip. Then find the actual tip.
3. Food bill: $\$ 33.65$; Tip: $15 \%$
\$4.50; \$5.05
4. Food bill: $\$ 44.28 ;$ Tip: $20 \%$ \$9; $\$ 8.86$
5. Food bill: $\$ 11.17$; Tip: $15 \%$ \$1.50; $\$ 1.68$
6. Food bill: $\$ 12.37$; Tip: $20 \%$ \$2; $\$ 2.47$
7. Food bill: $\$ 23.16$; Tip: $15 \%$ \$3; $\$ 3.47$
8. Food bill: $\$ 16.21 ;$ Tip: $20 \%$ \$4; $\$ 3.24$
9. Food bill: $\$ 37.54$; Tip: $25 \%$
10. Food bill: $\$ 25.96$; Tip: $20 \%$ \$5; $\$ 5.19$
11. Food bill: $\$ 28.93$; Tip: $15 \% ~ \$ 4.50 ; \$ 4.34$
12. Food bill: $\$ 72.79 ;$ Tip: $25 \% \$ 20 ; \$ 18.20$
13. Food bill: $\$ 19.82$; Tip: $23 \%$ $\qquad$
14. Food bill: $\$ 51.56$; Tip: $30 \%$ $\qquad$

REVIEW: Estimating and Finding a Sales Tax

## Key Concept and Vocabulary

To find the sales tax on an item, write the percent as a decimal or fraction and multiply it by the price of the item.


Name $\qquad$

Visual Model


Using a sales tax of $5 \%$, the sales tax on a $\$ 25$ shirt is $\$ 1.25$.

## Application Examples

1. $A$ DVD costs $\$ 20$ before tax. The sales tax is $7 \%$.

Estimate: Round 7\% to 5\%.

$$
0.05 \times 20=1
$$

$\therefore$ The estimate for the sales tax is $\$ 1$.
Actual: $0.07 \times 20=1.4$
$\because \quad$ The actual sales tax is $\$ 1.40$.
2. A bicycle costs $\$ 115$ before tax. The sales tax is $9 \%$.

Estimate: Round $9 \%$ to $10 \%$ and 115 to 120 .
$0.1 \times 120=12$
$\because$ The estimate for the sales tax is $\$ 12$.
Actual: $0.09 \times 115=10.35$
$\because \quad$ The actual sales tax is $\$ 10.35$.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Estimate the sales tax. Then find the actual sales tax.

3. BASEBALL CARDS The pack of baseball cards costs $\$ 3.75$ before tax. The sales tax is $4 \%$. \$0.20; \$0.15
4. TELEVISION A television costs $\$ 400$ before tax. The sales tax is $8 \%$.
\$40; \$32
5. MP3 PLAYER An MP3 player costs $\$ 89$ before tax. The sales tax is $6 \%$.
\$5; \$5.34
6. COUCH A couch costs $\$ 675$ before tax. The sales tax is $5 \%$.
\$35; \$33.75
7. GUITAR A guitar costs $\$ 299$ before tax. The sales tax is $9 \%$.
\$30; \$26.91
8. TABLE A table costs $\$ 50$ before tax. The sales tax is $4.5 \%$.
\$2.50; \$2.25
9. JEANS A pair of jeans costs $\$ 39$ before tax. The sales tax is $5.5 \%$.
\$2; \$2.15
$\qquad$ Finding a Discount

## Key Concept and Vocabulary

A discount is a decrease in the original price of an item. To find the discount, write the percent as a decimal or fraction and multiply it by the original price of the item.


Visual Model


## Application Examples

1. The original price of a book is $\$ 18.79$.

The discount is $20 \%$.
Estimate: Round 18.79 to 20 .

$$
0.2 \times 20=4
$$

$\because$ The estimate for the discount is $\$ 4$.
Actual: $0.2 \times 18.79 \approx 3.76$
$\therefore$ The actual discount is $\$ 3.76$. The sale price of the book is $\$ 18.79-\$ 3.76=\$ 15.03$.
2. The original price of a pair of in-line skates is $\$ 209.99$. The discount is $15 \%$.

Estimate: Round 209.99 to 200.

$$
0.15 \times 200=30
$$

$\therefore$ The estimate for the discount is $\$ 30$.
Actual: $0.15 \times 209.99 \approx 31.50$
$\because$ The actual discount is $\$ 31.50$. The sale price of the pair of in-line skates is $\$ 209.99-\$ 31.50=\$ 178.49$.

## PRACTICE makes PURR-FECT

## Estimate the discount. Then find the actual discount and the sale price.

3. TRUMPET The original price of a trumpet is $\$ 319.29$. The discount is $25 \%$.
\$75; \$79.82; \$239.47
4. SHOES The original price of a pair of shoes is $\$ 47.99$. The discount is $40 \%$.
\$20; \$19.20; \$28.79
5. LAMP The original price of a lamp is $\$ 17.09$. The discount is $15 \%$.
\$3; \$2.56; \$14.53
6. RING The original price of a ring is $\$ 96.75$. The discount is $60 \%$.
\$60; \$58.05; \$38.70
7. ELECTRONICS The original price of a home theater system is $\$ 243.89$. The discount is $75 \%$. \$187.50; \$182.92; \$60.97
8. BASEBALL The original price of a baseball glove is $\$ 26.99$. The discount is $30 \%$. \$9; \$8.10; \$18.89
9. SEWING MACHINE The original price of a sewing machine is $\$ 182.96$. The discount is $20 \%$. \$40; \$36.59; \$146.37
$\qquad$ and Multiplication

## Key Concept and Vocabulary

Associative Properties:
Commutative Properties:
$(a+b)+c=a+(b+c)$
$a+b=b+a$
$(a \cdot b) \cdot c=a \cdot(b \cdot c)$
$a \cdot b=b \cdot a$
Distributive Property:
$a(b+c)=a b+a c$
$a(b-c)=a b-a c$
Inverse Properties:
Identity Properties:
$a+0=0+a=a$
$a+(-a)=-a+a=0$
$a \cdot 1=1 \cdot a=a$


Multiplication Properties of 0 and -1 :
$a \cdot \frac{1}{a}=\frac{1}{a} \cdot a=1, a \neq 0$
$a \cdot 0=0 \cdot a=0$
$a \cdot(-1)=(-1) \cdot a=-a$

## Skill Examples

## Identify the property illustrated.

1. $-2 \cdot(7 \cdot 5)=-2 \cdot(5 \cdot 7)$
Commutative Property of Multiplication
2. $3(6 x+2)=18 x+6$

Distributive Property
2. $(-8) \cdot 1=-8$

Identity Property of Multiplication
4. $(w+3)+7=w+(3+7)$

Associative Property of Addition

Check your answers at BigIdeasMath.com.
6. $(-1) \cdot(-12)=12$

Mult. Prop. of -1
8. $0+11 c=11 c$

Identity Prop. of Add.
10. $(5-2 b)+3=(-2 b+5)+3$

Comm. Prop. of Add.
12. $\frac{1}{15 d} \cdot 15 d=1$

Inverse Prop. of Mult.
14. $\left(\frac{1}{16} k\right)(-32)=(-32)\left(\frac{1}{16} k\right)$

Comm. Prop. of Mult.

REVIEW: Distributive Property
Name $\qquad$


## Skill Examples

1. $3(9+4)=3 \cdot 9+3 \cdot 4$
2. $7(10-3)=7 \cdot 10-7 \cdot 3$
3. $6 \cdot 8+6 \cdot 7=6(8+7)$
4. $12 \cdot 9-12 \cdot 2=12(9-2)$
5. $5(2+5+3)=5 \cdot 2+5 \cdot 5+5 \cdot 3$

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

## Application Example

6. You buy 3 hot dogs for $\$ 1.25$ each and 3 sodas for $\$ 0.75$ each. Find the total cost.

$$
\begin{aligned}
3(1.25)+3(0.75) & =3(1.25+0.75) \\
& =3(2.00) \\
& =6
\end{aligned}
$$

## Use the Distributive Property to rewrite the expression.

7. $3(4+5)=3 \cdot 4+3 \cdot 5$
8. $5(8-3)=5 \cdot 8-5 \cdot 3$
9. $9(11+7)=\underline{9 \cdot 11+9 \cdot 7}$
$4 \cdot 7+4 \cdot 3+4 \cdot 2$
10. $8(27-9)=\underline{8 \cdot 27-8 \cdot 9}$
11. $6(17-7)=\underline{6 \cdot 17-6 \cdot 7}$
12. $4(7+3+2)=$
13. $5 \cdot 7+5 \cdot 3$ $\qquad$ 14. $2 \cdot 9-2 \cdot 6=2(9-6)$
14. $7 \cdot 4+7 \cdot 8=\underline{7(4+8)}$
15. 

$$
2(2+3)=2 \cdot 2+2 \cdot 3
$$

17. 



$$
3(3+2)=3 \cdot 3+3 \cdot 2
$$

18. MENTAL MATH You buy 5 hot dogs for $\$ 1.29$ each and 5 sodas for $\$ 0.71$ each.

Show how you can use mental math to find the total cost.
$\underline{5(1.29)}+5(0.71)=5(1.29+0.71)=5(2.00)=\$ 10$
19. EXTENSION Does the Distributive Property apply to a combination of addition and subtraction? Decide using the expression $3(7+5-4)$.
yes; $3(7+5-4)=3(8)=24$ and
$\underline{3(7+5-4)=3 \cdot 7+3 \cdot 5-3 \cdot 4=21+15-12=24}$

REVIEW: Comparing, Ordering, and Graphing Integers


## Skill Examples

1. $0 \leq 4 \quad$ " 0 is less than or equal to 4 "
2. $-1>-3$ " -1 is greater than -3 "
3. $-2<-1$ " -2 is less than -1 "
4. $2>-2$ " 2 is greater than -2 "
5. $3 \geq 2 \quad$ " 3 is greater than or equal to 2 "

Name $\qquad$

## Visual Model

Number Line

$-4<2$ because -4 is to the left of 2 on the number line.

## Application Example

6. The temperature in Seattle is $4^{\circ} \mathrm{F}$.

The temperature in Denver is $-6^{\circ} \mathrm{F}$. Which temperature is greater?

$$
-6<4 \quad "-6 \text { is less than } 4 "
$$

$\because \quad$ The temperature is greater in Seattle.

## PRACTICE MAKES PURR-FECT ${ }^{\text {mim }}$

Check your answers at BigIdeasMath.com.
Graph the two numbers. Then compare them using < or >.

8. -1


9. -1

10. 1

11. 0

12.


Order the temperatures from least to greatest.
13. $-5^{\circ} \mathrm{F}, 13^{\circ} \mathrm{F}, 0^{\circ} \mathrm{F}, 5^{\circ} \mathrm{F}, 2^{\circ} \mathrm{F}, 20^{\circ} \mathrm{F}$
$-5^{\circ} \mathrm{F}, 0^{\circ} \mathrm{F}, 2^{\circ} \mathrm{F}, 5^{\circ} \mathrm{F}, 13^{\circ} \mathrm{F}, 20^{\circ} \mathrm{F}$
14. $7^{\circ} \mathrm{C},-4^{\circ} \mathrm{C},-11^{\circ} \mathrm{C}, 0^{\circ} \mathrm{C}, 8^{\circ} \mathrm{C},-12^{\circ} \mathrm{C}$ $-12^{\circ} \mathrm{C},-11^{\circ} \mathrm{C},-4^{\circ} \mathrm{C}, 0^{\circ} \mathrm{C}, 7^{\circ} \mathrm{C}, 8^{\circ} \mathrm{C}$

Use an integer to describe the real-life situation.
15. A profit of $\$ 5$ $\qquad$ 5
16. A depth of 8 ft $\qquad$ $-8$
17. A decrease of $5^{\circ} \mathrm{F}$ $\qquad$ A loss of $\$ 5 \quad-5$

A height of 4 ft $\qquad$ An increase of $8^{\circ} \mathrm{F}$ $\qquad$ 8
18. BUSINESS LOSS During its first week, a business had a loss that was greater than $\$ 4$, but less than $\$ 6$. Circle each integer that could represent this loss.
$\begin{array}{llllllllllll}-\$ 7, & -\$ 6, & -\$ 5, & -\$ 4, & -\$ 3, & -\$ 2, & -\$ 1, & \$ 0, & \$ 1, & \$ 2, & \$ 3, & \$ 4,\end{array} 5, \quad \$ 6, \quad \$ 7$

REVIEW: Adding and Subtracting Integers

Key Concept and Vocabulary


Name $\qquad$

## Visual Model

To add a positive number, move to the right.


To subtract a positive number, move to the left.

## Application Example

6. The temperature is $8^{\circ} \mathrm{F}$ in the morning and drops to $-5^{\circ} \mathrm{F}$ in the evening. What is the difference between these temperatures?

$$
\begin{aligned}
8-(-5) & =8+5 \\
& =13
\end{aligned}
$$

$\because$ The difference is 13 degrees.

## PRACTICE makes PURR-FECT ${ }^{\text {™ }}$

Find the sum or difference.
7. $-2+3=\underline{1}$
8. $-4-5=\underline{-9}$
9. $8-2=\underline{6}$
10. $8-(-2)=10$
11. $-4-(-1)=-3$
12. $-5+(-5)=-10$
13. $4-(-8)=12$
14. $4-8=-4$
15. $-4+(-6)=-10$
16. $-4-(-6)=2$
17. $10-13=-3$
18. $13-(-10)=23$

## Write the addition or subtraction shown by the number line.

19. 


20.

21. TEMPERATURE The temperature is $16^{\circ} \mathrm{F}$ in the morning and drops to $-15^{\circ} \mathrm{F}$ in the evening. What is the difference between these temperatures? $\qquad$ 31 degrees
22. SUBMARINE A submarine is 450 feet below sea level. It descends 300 feet. What is its new position? Show your work. 750 feet below sea level; $-450-300=-750$

REVIEW: Multiplying and Dividing Integers

Key Concept and Vocabulary

$\qquad$

## Visual Model

$$
4 \cdot(-2)=(-2)+(-2)+(-2)+(-2)
$$



## Application Example

6. Each of your six friends owes you $\$ 5$. Use integer multiplication to represent the total amount your friends owe you.

$$
6 \cdot(-5)=-30
$$

$\therefore$ The total amount owed is $\$ 30$.

## Skill Examples

1. $-3 \cdot(-4)=12$
2. $-36 \div(-6)=6$
same sign, product and quotient positive
3. $-7 \cdot 0=0$
4. $-10 \div 5=-2 \longleftarrow$ different signs, product
5. $-5 \cdot 6=-30 \longleftarrow$ and quotient negative

## PRACTICE maKes PURR-FECT ${ }^{\text {m }}$

Check your answers at BigIdeasMath.com.
Find the product or quotient.
7. $-3 \times(-5)=\underline{15}$
8. $7(-3)=-21$
9. $0 \cdot(-5)=\underline{0}$
10. $(-5)(-7)=\underline{35}$
11. $-8 \cdot 2=\underline{-16}$
12. $(-5)^{2}=\underline{25}$
13. $(-3)^{3}=-27$
14. $4(-2)(-3)=\underline{24}$
15. $-16 \div 4=-4$
16. $-20 \div(-5)=\underline{4}$
17. $\frac{-9}{3}=-3$
18. $\frac{-20}{-10}=\underline{2}$

Complete the multiplication or division equation.
19. $-15 \div \underline{5}=-3$
20. $45 \div \underline{(-9)}=-5$
21. $-100 \div(-20)=5$
22. $8 \cdot(-8)=-64$
23. $-3 \cdot(-9)=27$
24. $-12 \cdot 8=-96$
25. TOTAL OWED Each of your eight friends owes you $\$ 10$. Use integer multiplication to represent the total amount your friends owe you. $8 \cdot(-10)=-80$;
The total amount owed is $\$ 80$.
26. TEMPERATURE The low temperatures for a week in Edmonton, Alberta are $-15^{\circ} \mathrm{C}$, $-12^{\circ} \mathrm{C},-10^{\circ} \mathrm{C},-12^{\circ} \mathrm{C},-18^{\circ} \mathrm{C},-20^{\circ} \mathrm{C}$, and $-25^{\circ} \mathrm{C}$. What is the mean low temperature for the week? Show your work.
$-16^{\circ} \mathrm{C} ;[-15+(-12)+(-10)+(-12)+(-18)+(-20)+(-25)] \div 7$
$=-112 \div 7=-16$

Name $\qquad$

## Operations with Rational Numbers

To add, subtract, multiply, or divide rational numbers, use the same rules for signs as you used for integers.

Example 1 Find (a) $-\frac{5}{6}+\frac{2}{3}$ and (b) $7.3-(-4.8)$.
a. Write the fractions with the same denominator, then add.

$$
-\frac{5}{6}+\frac{2}{3}=-\frac{5}{6}+\frac{4}{6}=\frac{-5+4}{6}=\frac{-1}{6}=-\frac{1}{6}
$$

b. To subtract a rational number, add its opposite.

$$
7.3-(-4.8)=7.3+4.8=12.1 \quad \text { The opposite of }-4.8 \text { is } 4.8
$$

Example 2 Find (a) $2.25 \cdot 8$, (b) $-2.25 \cdot(-8)$, and (c) $-2.25 \cdot 8$.
a. $2.25 \cdot 8=18$
b. $-2.25 \cdot(-8)=18$
c. $-2.25 \cdot 8=-18$

Example 3 Find $-\frac{4}{9} \div \frac{3}{4}$.
To divide by a fraction, multiply by its reciprocal.

$$
-\frac{4}{9} \div \frac{3}{4}=-\frac{4}{9} \cdot \frac{4}{3}=-\frac{4 \cdot 4}{9 \cdot 3}=-\frac{16}{27} \quad \text { The reciprocal of } \frac{3}{4} \text { is } \frac{4}{3} .
$$

## Practice

## Add, subtract, multiply, or divide.

1. $-7.5+3.8-3.7$
2. $-18.3+(-6.7)$
$-25$
3. $0.6-0.85-0.25$
4. $6.13-(-2.82) 8.95$
5. $-6 \cdot 4.75-28.5$
6. $-3.2 \cdot(-4.8) \quad 15.36$
7. $-1.8 \div(-9) \quad 0.2$
8. $3.6 \div(-1.5)-2.4$
9. $-\frac{1}{6}+\frac{5}{6} \quad \frac{2}{3}$
10. $-\frac{7}{10}+\left(-\frac{3}{5}\right)-1 \frac{3}{10}$
11. $\frac{4}{9}-\frac{2}{3}-\frac{2}{9}$
12. $-\frac{5}{6}-\frac{1}{4}-1 \frac{1}{12}$
13. $-\frac{3}{2} \cdot\left(-\frac{1}{8}\right) \quad \frac{3}{16}$
14. $-\frac{3}{4} \cdot \frac{7}{12}-\frac{7}{16}$
15. $\frac{5}{8} \div\left(-\frac{1}{4}\right)-2 \frac{1}{2}$
16. $-\frac{4}{7} \div \frac{2}{5} \quad-1 \frac{3}{7}$
17. TEMPERATURE The temperature at midnight is shown. The outside temperature decreases $2.3^{\circ} \mathrm{C}$ over the next two hours. What is the outside temperature at 2 A.m.? $-33.2^{\circ} \mathrm{C}$
18. SNOWFALL In January, a city's snowfall was $\frac{5}{8}$ foot below the historical average. In February, the snowfall was $\frac{3}{4}$ foot above the historical average. Was the city's snowfall in the two-month period above or below the historical average? By how much?

above average; $\frac{1}{8}$ foot

REVIEW: Writing Expressions and Equations


## Skill Examples

1. Five times a number: $5 n$
2. Six less than three times a number: $3 n-6$
3. The sum of a number and one: $n+1$
4. A number divided by three: $n \div 3$

Name $\qquad$

## Visual Model



## Application Example

5. Write an equation for the following. "The price of $\$ 15$ is the wholesale cost plus a markup of fifty percent."
Let $C$ be the wholesale cost. $50 \%$ of $C$ is $0.5 C$.

## PRACTICE makes PURR-FECT ${ }^{\text {m }}$

家 $\because$ An equation is $15=C+0.5 C$.

Write the verbal phrase as a mathematical expression.
6. The product of a number and two
$2 n$
8. 19 less than twice a number

$$
2 n-19
$$

10. Five times the sum of a number and two

$$
5(n+2)
$$

7. 10 subtracted from a number
$\qquad$
8. The sum of a number and three, divided by four $\frac{n+3}{4}$
9. Seven less than four times a number

$$
4 n-7
$$

## Write the sentence as an equation.

12. Three times a number equals nine.

$$
3 n=9
$$

14. Twelve divided by a number is four. $\frac{12}{n}=4$
15. The difference of a number and nine is four.

$$
n-9=4
$$

15. The sum of a number and seven is eighteen.

$$
n+7=18
$$

16. The volume of a cone is one-third the area of the base times the height. A cone has a volume of $20 \pi$ cubic inches. Write an equation that can be used to solve for the height of the cone.

$$
20 \pi=\frac{1}{3} \cdot 4 \pi \cdot h
$$

REVIEW: Writing and Graphing Inequalities


## Skill Examples

1. $x>0$ : All positive numbers
2. $x \geq 0$ : All nonnegative numbers
3. $x<0$ : All negative numbers
4. $x \leq 0$ : All nonpositive numbers

Name $\qquad$

## Visual Model



## Application Example

5. A sign at a clothing store reads "Savings up to $70 \%$." Let $S$ represent the percent of savings. Write an inequality to describe $S$.
$S$ can be equal to $70 \%$.
Or $S$ can be less than $70 \%$.

## PRACTICE maKes PURR-FECT ${ }^{\text {Tm }}$

Check your answers at BigIdeasMath.com.

## Write an inequality for the statement.

6. All numbers that are less than 24

$$
x<24
$$

8. All numbers greater than 10

$$
x>10
$$

10. All numbers that are at least 11

$$
x \geq 11
$$

Graph the inequality.
12. $x>-1$

14. $x \leq 3$

7. All numbers that are at most 3
$\qquad$
9. All numbers that are no more than 5

$$
x \leq 5
$$

11. All numbers less than or equal to 8
$\qquad$
12. $x<4$

13. $x \geq 0$

14. A sign at a shoe store reads "Savings up to $60 \%$." Let $P$ represent the percent of savings. Write an inequality to describe $P$.
$\qquad$


REVIEW: Evaluating Expressions
Name $\qquad$
Key Concept and Vocabulary

Expression: $2 x^{2}+3 x-6$
Evaluate when $x=2$.

$$
\begin{aligned}
2\left(2^{2}\right)+3(2)-6 & =8+6-6 \\
& =8
\end{aligned}
$$



## Skill Examples

1. When $x=5,3 x+4$ is $3(5)+4=19$.
2. When $x=-1,5 x+7$ is $5(-1)+7=2$.
3. When $x=3,4 x^{2}$ is $4\left(3^{2}\right)=36$.
4. When $x=4, x^{3}+1$ is $4^{3}+1=65$.

## Visual Model

| $\boldsymbol{x}$ | $\mathbf{2} \boldsymbol{x}+\mathbf{3}$ | Value of Expression |
| :---: | :---: | :---: |
| 1 | $2(1)+3$ | 5 |
| 2 | $2(2)+3$ | 7 |
| 3 | $2(3)+3$ | 9 |
| 4 | $2(4)+3$ | 11 |

## Application Example

5. For a Celsius temperature $C$ the Fahrenheit temperature $F$ is $\frac{9}{5} C+32$. Find $F$ when $C=25^{\circ}$.

$$
\begin{aligned}
\frac{9}{5} C+32 & =\frac{9}{5}(25)+32 \\
& =45+32 \\
& =77
\end{aligned}
$$

$\because$ The Fahrenheit temperature is $77^{\circ}$.

Check your answers at BigIdeasMath.com.

Evaluate the expression.
6. When $x=2,3 x-1=-5$.
8. When $x=4, x^{2}-5=$ $\qquad$ .
10. When $x=3.1,5 x+0.5=$ $\qquad$ 16 .
12. When $x=10, x^{2}-8 x+11=$ $\qquad$ 31 -.

## Evaluate the perimeter when $x=3$.

14. 

$P=$ $\qquad$
13. When $x=2 \frac{1}{2}, 6 x+3=$ $\qquad$ .
15.
$P=$ $\qquad$ 17
7. When $x=-1,3 x+9=\frac{6}{\frac{3}{4}}$.
9. When $x=\frac{1}{2}, 3 x^{2}=$
11. When $x=0,4 x^{2}+5=$ $\qquad$ 5 18
.

16. CARDINAL The weight of the cardinal (in ounces) is $0.6 x+11$ after its eats $x$ ounces of bird seed. How much does it weigh after it eats 2 ounces of bird seed? $\qquad$ 12.2 oz


REVIEW: Simplifying Expressions
Name $\qquad$

## Visual Model



## Application Example

5. The original cost of a shirt is $x$ dollars. The shirt is on sale for $30 \%$ off. Write a simplifed expression for the sale cost.

## 30\% Off

3. $(2 x+3)-(x+2)=x+1$

$$
x-0.3 x=0.7 x
$$

4. $2(y-1)+3(y+2)=5 y+4$

## PRACTICE makes PURR-FECT ${ }^{\text {tm }}$ <br> Simplify the expression. (Remove parentheses and combine like terms.)

Check your answers at BigIdeasMath.com.
6. $4 x+6 x=$ $\qquad$ 7. $3 n+5-2 n=$ $\qquad$ $n+5$
8. $9 x+3-6 x-2=$ $\qquad$ 9. $3(x+2)=$ $\qquad$ $3 x+6$
10. $7 m-2 m+5 m=$ $\qquad$ 11. $2-(x+1)=$ $\qquad$
12. $(3 x+6)-x=$ $\qquad$ 13. $5-(1-n)=$ $\qquad$
14. $(x+6)-(x+6)=$ $\qquad$ 15. $(4 x-2)+3(x+1)=7 x+1$
16. $(5 x+4)-2(x+1)=$ $\qquad$ 17. $5(x+2)-2(x+2)=3 x+6$

## Write a simplified expression for the perimeter of the rectangle or triangle.

18. 



Perimeter $=\underline{30 x}$


Perimeter $=\underline{28 n}$
20.


Perimeter $=\underline{57 x}$
21. The original cost of a cell phone is $x$ dollars. The phone is on sale for $35 \%$ off. Write a simplified expression for the sale cost. $\qquad$ 0.65x


