Student Name: _____ Date: _____	Contact Person Name: _____ Phone Number: _____

Texas Assessment of Knowledge and Skills

Exit Level Math Review

Lesson 7

Writing Equations from Sentences

TAKS Objective 2 – Demonstrate an understanding of the properties and attributes of functions

Lesson Objectives:

- Identify an algebraic expression or equation
- Formulate an equation or expression equivalent to a situation written in English

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The Texas Assessment of Knowledge and Skills (TAKS) exit level exam covers ten learning objectives. These lessons are designed to teach math concepts specific to each objective as well as strategies to consider when approaching typical TAKS questions. To successfully complete the TAKS exit level exam, the student should be able to:

1) **Describe functional relationships in a variety of ways.**
2) **Demonstrate an understanding of the properties and attributes of functions.**
3) **Demonstrate an understanding of linear functions.**
4) **Formulate and use linear equations and inequalities.**
5) **Demonstrate an understanding of quadratic equations and other nonlinear functions.**
6) **Demonstrate an understanding of geometric relationships and spatial reasoning.**
7) **Demonstrate an understanding of two- and three-dimensional representations of geometric relationships and shapes.**
8) **Demonstrate an understanding of concepts and uses of measurement and similarity.**
9) **Demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems.**
10) **Demonstrate an understanding of the mathematical processes and tools used in problem solving.**

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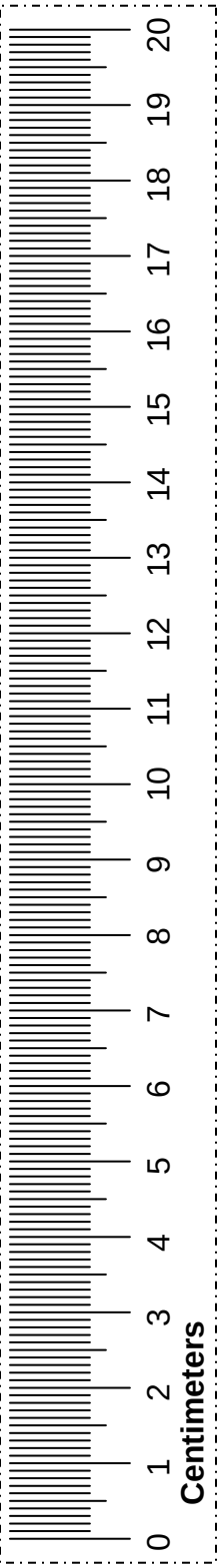
TAKS Mathematics Chart



Length

Metric	Customary
1 kilometer = 1000 meters	1 mile = 1760 yards
1 meter = 100 centimeters	1 mile = 5280 feet
1 centimeter = 10 millimeters	1 yard = 3 feet
	1 foot = 12 inches

Capacity and Volume

Metric	Customary
1 liter = 1000 milliliters	1 gallon = 4 quarts
	1 gallon = 128 fluid ounces
	1 quart = 2 pints
	1 pint = 2 cups
	1 cup = 8 fluid ounces

Mass and Weight

Metric	Customary
1 kilogram = 1000 grams	1 ton = 2000 pounds
1 gram = 1000 milligrams	1 pound = 16 ounces

Time

1 year = 365 days

1 year = 12 months

1 year = 52 weeks

1 week = 7 days

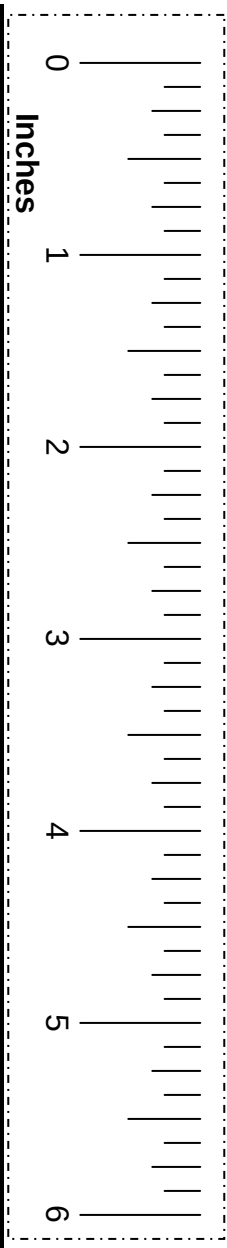
1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds

TAKS Mathematics Chart

Perimeter	Rectangle	$P = 2l + 2w$ or $P = 2(l + w)$
Circumference	Circle	$C = 2\pi r$ or $C = \pi d$
Area	Rectangle	$A = lw$ or $A = bh$
	Triangle	$A = \frac{1}{2}bh$ or $A = \frac{bh}{2}$
	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$ or $A = \frac{(b_1+b_2)h}{2}$
	Regular polygon	$A = \frac{1}{2}aP$
	Circle	$A = \pi r^2$
P represents the perimeter of the base of a three-dimensional figure.		
B represents the area of the base of a three-dimensional figure.		
Surface Area	Cube (total)	$S = 6s^2$
	Prism (lateral)	$S = Ph$
	Prism (total)	$S = Ph + 2B$
	Pyramid (lateral)	$S = \frac{1}{2}Pl$
	Pyramid (total)	$S = \frac{1}{2}Pl + B$
	Cylinder (lateral)	$S = 2\pi rh$
	Cylinder (total)	$S = 2\pi rh + 2\pi r^2$ or $S = 2\pi r(h + r)$
	Cone (lateral)	$S = \pi rl$
	Cone (total)	$S = \pi rl + \pi r^2$ or $S = \pi r(l + r)$
	Sphere	$S = 4\pi r^2$
Volume	Prism or Cylinder	$V = Bh$
	Pyramid or Cone	$V = \frac{1}{3}Bh$
	Sphere	$V = \frac{4}{3}\pi r^3$
Special Right Triangles	30°, 60°, 90°	$x,\ x\sqrt{3},\ 2x$
	45°, 45°, 90°	$x,\ x,\ x\sqrt{2}$
Pythagorean Theorem		$a^2 + b^2 = c^2$
Distance Formula		$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line		$m = \frac{y_2 - y_1}{x_2 - x_1}$
Midpoint Formula		$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
Quadratic Formula		$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Slope-Intercept Form of an Equation		$y = mx + b$
Point-Slope Form of an Equation		$y - y_1 = m(x - x_1)$
Standard Form of an Equation		$Ax + By = C$
Simple Interest Formula		$I = prt$



Mathematics, like Spanish, English, and Japanese, is a language. Certain words of every spoken language translate into math symbols and operations. For the TAKS exam, you must recognize the mathematic translation of certain English words. Notice how the following key words are used in English, and how they translate algebraically.

Let n be a number.

Addition		
Key Words	**English Expression**	**Algebraic Expression**
plus	6 plus a number	$6 + n$
added to	a number added to 6	$6 + n$
increased by	a number increased by 6	$n + 6$
more than	6 more than a number	$n + 6$
sum	the sum of 6 and a number	$6 + n$
total	the total of 6 and a number	$6 + n$

Subtraction		
Key Words	**Word Expression**	**Algebraic Expression**
minus	5 minus a number	$5 - n$
	a number minus 5	$n - 5$
difference	The difference of a number and 5	$n - 5$
	The difference of 5 and a number	$5 - n$
decreased by	a number decreased by 5	$n - 5$
	5 decreased by a number	$5 - n$
subtracted from*	5 subtracted from a number	$n - 5$
	a number subtracted from 5	$5 - n$
less than*	5 less than a number	$n - 5$
	a number less than 5	$5 - n$

* With "subtracted from" and "less than," the order we subtract in is the reverse order from how we read the words. For example, "10 less than a number" means $n - 10$.

Think Back

Just as 5 – 4 and 4 – 5 are not the same, saying "five minus a number" is different from saying "a number minus 5."

A **let statement** is a sentence that defines a variable. Examples are:

- Let *x* be the unknown number.
- Let *h* represent the height of a person.
- Let *d* represent the distance traveled.

Problem Solving Tip

Choose variables that hint at their meaning. For example, choose *h* for height, *a* for age, *d* for distance, *w* for width, *l* for length, *r* for radius, etc.

Example

Write an algebraic expression for the following phrase: thirteen more than a number.

Solution

First, read the problem for key words. Circle words that tell which operation to use. Underline words that will be a variable.

Step 1: Read, underline, and circle. **+**

thirteen (more than) a number.

Since "more than" means add, we put a plus sign above our circle.

Step 2: Create a let statement.

We underlined "a number." Our let statement will be as follows:

Let n be a number.

Step 3: Translate

Thirteen more than a number is written as:

$$n + 13$$

Example

Write an algebraic expression that means "twenty-five less than Harold's height, *h*."

Solution

Step 1: **–**

twenty-five (less than) Harold's height, *h*.

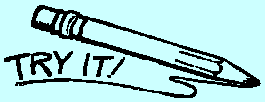
Step 2: We are given the variable in this problem, but it is good practice to use a let statement.

Let h be Harold's height.

Step 3:

$$h - 25$$

Notice that the answer is not $25 - h$, a common mistake.



Write an algebraic expression equivalent to each phrase. Use *n* as your variable.

1) three plus a number

2) a number minus eight

3) the sum of nineteen and a number

4) the difference of three and a number

5) twelve less than a number

Certain words and phrases represent multiplication and division.

Let *x* be a number.

Multiplication		
Key Words	**Word Expression**	**Algebraic Expression**
times	4 times a number	$4x$
multiplied by	a number multiplied by 4	$4x$
product	the product of 4 and a number	$4x$
twice	twice a number	$2x$
double	double a number	$2x$
triple	triple a number	$3x$
of	$\frac{2}{3}$ of a number	$\frac{2}{3}x$

Let *a* represent a number.

Division		
Key Words	**Word Expression**	**Algebraic Expression**
quotient	the quotient of a number and 7	$\frac{a}{7}$
divided by	a number divided by 7	$\frac{a}{7}$

Use a fraction to show division.

Example

Write an algebraic expression equivalent to the phrase: "the product of ninety and a number."

Solution •

the product of ninety and a number.

Let *n* be a number.

$90n$

Example

Write an algebraic expression to represent "sixteen divided by a number."

Solution ÷

sixteen divided by a number.

Let *n* be a number.

$$\frac{16}{n}$$

Sometimes there is more than one key word.

Example

Write an algebraic expression to represent the phrase: “three plus one-fourth of a number.”

Solution

$+$ $\quad$ $\bullet$

three (plus) one-fourth (of) a number.

Let x be a number.

$$3 + \frac{1}{4}x$$

Notice that we may use any letter as a variable, as long as we define it in our let-statement.

Example

Write an algebraic expression that means “three times the difference of a number and four.”

Solution

$\bullet$ $\quad$ $-$

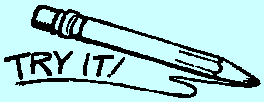
three (times) the (difference of) a number and four

Let n be a number.

$$3(n - 4)$$

Notice that we need parentheses. Parentheses show that the entire difference is being multiplied by three. A common error with this problem is to write $3n - 4$. However, this means “three times a number, minus four.”

Difference and **sum** are key words that tell us to group subtraction or addition in parentheses.



Write an algebraic expression equivalent to each phrase. Use *n* as your variable, unless one is specified already.

6) the product of nine and a number

7) six times the sum of a number and two

8) five times the sum of *x* and *y*

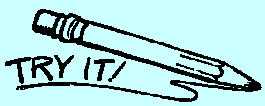
9) eight less than half the sum of four and a number

10) the quotient of 3 and a number

Algorithm

To translate an equation:

1) Put a box around words that mean equal. Circle words that stand for operations (+, -, •, ÷). Underline words that will be a variable.
2) Create a variable using a let statement.
3) Write the equation, and solve for the variable you created in Step 2, if necessary.



Write an equation equivalent to each sentence. Do not solve it. Use *n* as your variable.

11) A number added to three is seven.

12) The difference of a number and six is fourteen.

13) Eighteen subtracted from a number is thirty-seven.

14) The product of four and a number is twenty-eight.

You must also write math sentences, called equations, from English.

Example

Lucile is twice as old as Mark. If the sum of their ages is 33, which equation can be used to find their ages?

A $2x^2 = 33$

B $x + 2 = 33$

C $3x = 33$

D $3x + 5 = 33$

Solution

(1) Read the question, and decide which values are unknown.

Lucile's age and Mark's age are unknown.

(2) Define a variable.

Lucile's age is given in terms of Mark's age. Let x be Mark's age.

(3) Write all unknown quantities in terms of the variable.

x = Mark's age

$2x$ = Lucile's age

(4) Using the information from the question, write an equation.

We are told "the sum of their ages is 33." So Mark's age + Lucile's age = 33.

$$x + 2x = 33$$

(5) Check if this equation is an answer choice.

$x + 2x = 33$ *is not a choice.*

(6) Simplify the equation if possible.

$$x + 2x = 33$$
$$3x = 33$$

(7) Check if this equation is an answer choice.

The answer is choice **C**.

15) Jeremy's age is three years less than his brother Jeff's age, x. If their ages total 51, which equation can be used to find their ages?

A $2x - 3 = 51$

B $2x + 3 = 51$

C $x^2 = 51$

D $x^2 - 3 = 51$

Example

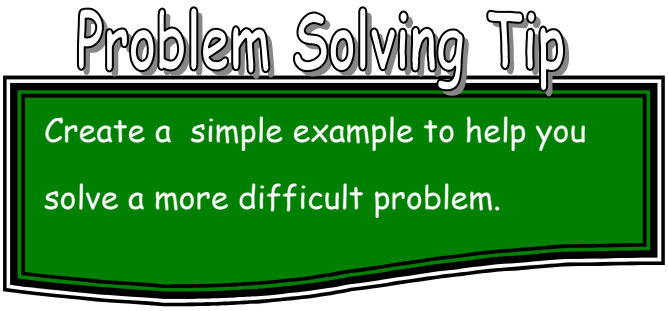
Roxanne bought seven more oranges than she did watermelons. Oranges cost \$0.38 each and watermelons cost \$3.12 each. If w represents the number of watermelons Roxanne bought, which expression represents the total cost of the fruit she purchased?

A $5.78w + 21.84$

B $5.78w + 2.66$

C $3.50w + 21.84$

D $3.50w + 2.66$



Solution

This problem may seem difficult. Let's think about a similar, simpler problem to help us.

What if Roxanne were only buying watermelons?

1 watermelon costs \$3.12.

2 watermelons cost \$6.24.

Continue this until you discover the rule to find the total cost of watermelon.

The rule: multiply the cost of one watermelon (\$3.12) by the number of watermelons purchased. Since we are told w is the number of watermelons, the price of the watermelon is $3.12w$. From this, we can form an idea of how to construct the cost of fruit:

$$(3.12)(\text{number of watermelons}) + (0.38)(\text{number of oranges})$$

What is the number of oranges?

Since Roxanne buys seven more oranges than watermelons, $w + 7$ is the number of oranges. We can simplify the expression now.

$$(3.12)(\text{number of watermelons}) + (0.38)(\text{number of oranges})$$

$$(3.12)(w) + (0.38)(w + 7)$$

This is not an answer choice. We need to simplify this expression.

$(3.12)(w) + (0.38)(w + 7)$ Distribute

$= 3.12w + 0.38w + 2.66$

$= 3.50w + 2.66$ Combine w-terms.

The answer is choice **D**.

16) Renee has two more dimes than she has nickels. If n stands for the number of nickels Renee has, which expression represents the amount of money she has?

A $0.05n + 0.10n + 2$

B $0.15n + 0.20$

C $3n + 20$

D $15n + 20$

Algorithm

To write an equation given a situation:

1) Decide which quantities are unknown.
2) Define one of them to be your variable. Use the one with the least amount of information given as the variable.
3) Write the rest of the unknowns in terms of the variable.
4) Write the equation that applies to the situation given.
5) Simplify the equation if you can (usually this means to combine like terms or distribute).

Review

Know these concepts:

1. Translate directly from English to algebra.
    a. Circle words that stand for operations.
    b. Underline words that will stand for a variable.
    c. Put a box around words meaning “equal.” Usually, that’s the word “is.”
2. Translate a situation into an expression or equation.
    a. Identify all unknown quantities.
    b. Define a variable.
    c. Write all unknowns in terms of the variable.
    d. Write the equation according to the situation.
3. If a problem is very difficult, write an easier problem that is similar and solve it. Its solution may give you ideas to solve the more difficult one.

Practice Problems
Lesson 7

Directions: Write your answers in your math journal. Label this exercise

TAKS Review – Lesson 7.

Write the expression or equation equivalent to each phrase or sentence. Use *x* as a variable. Do not solve any equations.

1) The sum of a number and twenty

2) Triple Harry’s age

3) Nine decreased by a number

4) The product of three more than a number and two

5) Two less than two-thirds of a number

6) Eight times a number is sixty-four.

7) Twice a number, minus fifteen, is five.

8) Wally's sky-diving company charges \$150 for airplane rental, and an additional \$25 per skydiver. Which equation best represents the relationship between the number of skydivers, *s*, and the total charges, *c*?

A $c = 150 + 25$

B $c = 150 + 25s$

C $c = 150s + 25s$

D $c = 150s + 25$

9) Buster buys 6 tomatoes for a total cost of \$2. The total cost, *c*, of purchasing *n* tomatoes can be found by –

A multiplying *n* by *c*

B multiplying *n* by the cost of 1 tomato

C dividing *n* by *c*

D dividing *c* by the cost of 1 can

10) Jerry has 2 more ruffled shirts than George. Elaine has half as many ruffled shirts as Jerry. The three of them have 8 ruffled shirts. Which equation can be used to find how many ruffled shirts Jerry has?

A $x + 2x + \frac{1}{2}x = 8$

B $x + (x + 2) + \frac{1}{2}x = 8$

C $x + (x + 2) + \frac{1}{2}(x + 2) = 8$

D $x + 2x + \frac{1}{2}(2x) = 8$

11) The height in inches, $h(x)$, of a Tyrannosaurus rex can be estimated by multiplying the length of the femur in inches, x, by 4.10, then adding 43.42 to the product. Which of the following best represents this relationship?

A $h(x) = (4.10 + x)(43.42)$

B $h(x) = 4.10(x + 43.42)$

C $h(x) = 4.10x + 43.42$

D $h(x) = \frac{x}{4.10} + 43.42$

1) $3+n$

2) $n-8$

3) $19+n$

4) $3-n$

5) $n-12$

6) $9n$

7) $6(n+2)$

8) $5(x+y)$

9) $\frac{1}{2}(4+n)-8$

10) $\frac{3}{n}$

11) $3+n=7$

12) $n-6=14$

13) $n-18=37$

14) $4n=28$

15) Let Jeff's age be x. Let Jeremy's age be $x-3$.

$x+x-3=51$

$2x-3=51$

The answer is choice **A**.

16) Let n be the number of nickels. Let $n+2$ be the number of dimes.

Setup: $0.05n+0.10(n+2)$ Answer: **B**

End of Lesson 7