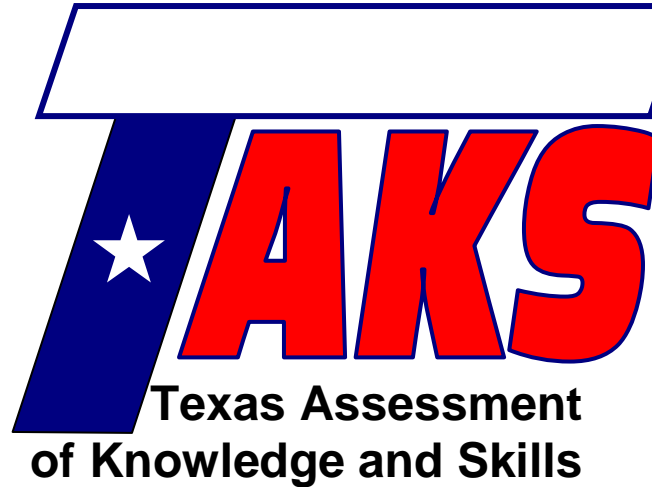


Student Name: _____

Date: _____

Contact Person Name: _____

Phone Number: _____



Exit Level Math Review

Lesson 27

Statistics

TAKS Objective 9 – Demonstrate an understanding of percents, proportional relationships, probability, and statistics in application problems

Lesson Objectives:

- Be able to calculate and decide when to use measures of central tendency: mean, median, mode, and range

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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

1 kilometer = 1000 meters
1 meter = 100 centimeters
1 centimeter = 10 millimeters

Customary

1 mile = 1760 yards
1 mile = 5280 feet
1 yard = 3 feet
1 foot = 12 inches

Capacity and Volume

Metric

1 liter = 1000 milliliters

Customary

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

1 kilogram = 1000 grams
1 gram = 1000 milligrams

Customary

1 ton = 2000 pounds
1 pound = 16 ounces

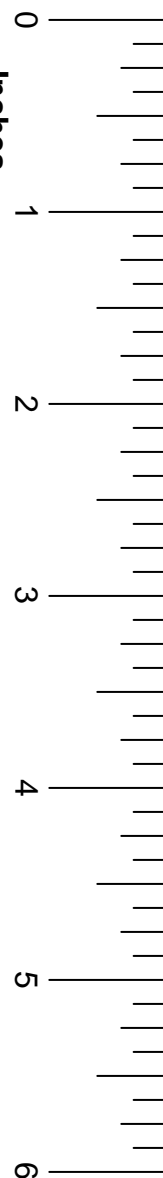
Time

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		$I = prt$

Inches



Statistics is the branch of mathematics concerned with organizing data.

There are many ways to organize data. You must be familiar with four of those ways: range, mode, median, and mean. Imagine you have a contest against Pietro to see who kicks a soccer ball the farthest. Here are the results of the contest.

Kicking Distance

You: 55, 55, 61, 61, 44

Pietro: 70, 29, 40, 40, 43

In a data set, the **range** is the difference between the highest and lowest numbers.

Your range is $61 - 44 = 17$.

Pietro's Range is $70 - 29 = 41$.

Your kicks were more consistent than Pietro's.

Examples

The range of {8, 4, 7, 1, 3, 10} is $10 - 1 = 9$.

The range of {35, -7, 1, 19, 40} is $40 - -7 = 47$.

FACT

Range is used to show how much a set of numbers vary. A low range indicates consistent data. A large range indicates a big spread between data.



TAKS Review

In a data set, the **mode** is the score, or scores, that occur most often.

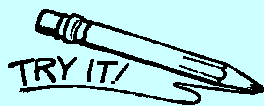
Your kicks have 2 modes: 55 and 61
Pietro's kicks have one mode: 40

Examples

The mode of $\{1, 5, 23, 13, 9, 13, 2\}$ is 13, since it has the highest frequency: 2.

The set $\{1, 4, 83, 12\}$ has **no mode**, since each number has a frequency of 1. Also, $\{2, 2, 4, 4, 13, 13, 9, 9\}$ has no mode, since each number has the same frequency, 2.

The set $\{4, 3, 6, 6, 5, 5, 5, 2, 2, 2\}$ has two modes, 5 and 2, since these values have a frequency of 3, and there are other numbers with lower frequencies in the list. Notice that even though 6 has a higher frequency than 4 and 3, it is not a mode.



Calculate the range and the mode of each data set.

- 1) $\{12, 14, 15, 9, 65, 14, 13, 50\}$ 2) $\{-1, 18, 44, 0, 3\}$

In a list of numbers, the **mean** is the average of all the numbers. The mean is the sum of all the numbers divided by the number of items in the list.

For example, the mean of {4, 3, 8, 12, 4} is

$$\frac{4 + 3 + 8 + 12 + 4}{5} = \frac{31}{5} = 6.2$$

Example

You want to find the mean distance of your kicks. Once again, the distances of your kicks were {55, 55, 61, 61, 44}

Step 1: Find the sum of the numbers.

$$55 + 55 + 61 + 61 + 44 = 276$$

Step 2: Divide the sum by the amount of numbers.

You made 5 kicks, so there are 5 numbers in this data set.

$$\frac{276}{5} = 55.2$$

Notice that none of your kicks was 55.2 yards, but your average distance was 55.2 yards. Try to think about the mean as a mixture of all the values. With colors, when you mix two colors together, say red and yellow, you end up with something that is not red or yellow, but something that has qualities of both colors: orange. Even though you didn't ever kick a ball 55.2 yards, when all your kicks were mixed together, the result was 55.2 yards.

Example

Pietro's kicks were {70, 29, 40, 40, 43}.

Pietro's mean distance is:

$$\frac{70 + 29 + 40 + 40 + 43}{5} = 44.4$$

The **median** of a set of data is the middle number when the set is arranged from lowest to highest or from highest to lowest. If there is an even number of data entries, the median is the mean of the middle two values.

$$\begin{array}{c} \{55, 55, 61, 61, 44\} \\ \downarrow \\ \{44, 55, 55, 61, 61\} \\ \downarrow \\ \{44, 55, \textcircled{55}, 61, 61\} \end{array}$$

Examples

To find the median of $\{1, 3, 5, 2, 4\}$, reorder it from least to greatest (or from greatest to least) $\{1, 2, 3, 4, 5\}$. Next, find the middle value. It is 3. The median is 3.

To find the median of $\{6, 7, 1, 2, 5, 3\}$,

Step 1: Reorder

$$\{6, 7, 1, 2, 5, 3\} \rightarrow \{1, 2, 3, 5, 6, 7\}$$

Step 2: Find the middle

One way to do this is to cover each outside number with a finger and move them evenly toward the center.

$$\{\bullet 2, 3, 5, 6, \bullet\}$$

$$\{1, \bullet 3, 5, \bullet 7\}$$

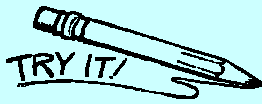
$$\{1, 2, \boxed{3, 5}, 6, 7\}$$

Step 3: Find the median

In this case, take the average of the middle two numbers.

$$\frac{3 + 5}{2} = \frac{8}{2} = 4$$

The median is 4.



Find the mean and median of each data set. Round to the nearest tenth.

3) {52, 2, 4, 19, 22, 4}

4) {5, 38, 2, 13, 44, 12, 11}

You must also know when to use the mean, median, mode, and range.

Problem Solving Tip

Think of ways to remember the definitions. The word "mode" sounds like "most." The mode describes numbers that show up the most. Say "mode most" ten times. Repeat the phrase "median middle" ten times to help you remember its definition.

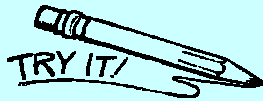
Example

Marie recorded the closing price of a stock each day for a month. Which measure of data did she use to determine that the closing stock price varied by \$42.29 during the month?

- A Mean
- B Median
- C Mode
- D Range

Solution

The key word here is “varied.” The only measure of variance is the range. The answer is choice **D**.



5) A used-boat dealer has boats for sale for \$600, \$690, \$695, \$710, \$725, \$750, \$850, \$995, \$995, \$995, and \$1,495. Select the most effective measure to use to convince potential customers that the dealer’s prices are very low.

- | | |
|---------------|-----------------|
| A Mean | B Median |
| C Mode | D Range |

You may face word problems involving these measures.

Example

In order to afford her car payment, Subia needs to earn an average of \$150 per week from her part-time job by the end of her fourth week. Her first 3 weekly paychecks were for \$100, \$170, and \$105. Which equation can Subia use to find how much she must earn in the 4th week in order to meet her goal?

A $\frac{x + 375}{3} = 150$

B $\frac{x + 375}{4} = 150$

C $x + 150 = \frac{375}{3}$

D $\frac{x + 150}{4} = 375$

Solution

Recall how to find the average, or mean, of a set of numbers.

Add all the numbers and divide by the number of values.

We want to find when the average of 4 week's pay will be \$150.

$$\frac{1^{\text{st}} \text{ week} + 2^{\text{nd}} \text{ week} + 3^{\text{rd}} \text{ week} + 4^{\text{th}} \text{ week}}{4} = 150$$

$$\frac{100 + 170 + 105 + x}{4} = 150$$

$$\frac{375 + x}{4} = 150$$

We see that there is an equivalent form of this result as an answer choice.

The answer is choice **B**.

Problem Solving Tip

Set up an equation with words, then with variables, if you are having difficulty.

Test questions may involve a variety of techniques we have covered.

Example

For each grading period, Mr. Splinter gives his students one group project and two exams. The project counts as 20% of each student's final grade, and the mean of the 2 scores counts as the rest of the grade. In Mr. Splinter's class, Anthony earned a grade of 87 on his first exam and a grade of 96 on his second exam. Which of the following is a reasonable minimum grade Anthony must score on his project in order to have a final grade of at least 90?

- A 66
- B 84
- C 87
- D 92

Solution

First, we must understand how Mr. Splinter calculates his grades.

From the question, 20% of the final grade is the project, which leaves 80% as the average of the two exams. As decimals, 20% = 0.2 and 80% = 0.8.

Begin setting up an equation.

$$\text{final grade} = 0.2 (\text{project grade}) + 0.8 (\text{mean exam score})$$

$$90 = 0.2p + 0.8 \left(\frac{87 + 96}{2} \right)$$

Use a variable for what you wish to find.

$$90 = 0.2p + 0.8 \left(\frac{183}{2} \right)$$

$$90 = 0.2p + 0.8 (91.5)$$

$$\begin{array}{r} 90 = 0.2p + \cancel{73.2} \\ -73.2 \qquad \qquad \cancel{-73.2} \end{array}$$

$$16.8 = 0.2p$$

Solve for p .

$$\frac{16.8}{0.2} = \frac{\cancel{0.2}p}{\cancel{0.2}}$$

$$84 = p \quad \text{The answer is choice B.}$$

Simplify the right-hand side using correct order of operations: **PEMDAS** (Parentheses, Exponents, Multiplication and Division from left to right, Addition and Subtraction from left to right).



- 6) Veronica needs an overall average of 85 to be able to play field hockey for her school. She has a 75 in English, a 92 in Math, and an 80 in Biology. Which represents the minimum Social Studies grade Veronica needs to earn to be able to play field hockey?
- A 93
 - B 90
 - C 87
 - D 85

Review

Know these concepts:

1. Range is the largest value minus the smallest value of a data set.
 - a. It is a measure of how varied the data is.
2. Mode is the value(s) with the highest frequency.
3. Mean is the average of the numbers in a data set.
 - a. To find it, add all the numbers and divide by the number of values.
4. Median is the middle value of a data set arranged from lowest to highest or from highest to lowest.
 - a. If there is an even number of data points, average the middle two numbers.



Practice Problems

Lesson 27

Directions: Write your answers in your math journal. Label this exercise
TAKS Review – Lesson 27.

- 1) Jamie's math class has 20 people in it. Here are the scores on the most recent test they took:
{90, 84, 77, 89, 99, 98, 79, 89, 88, 98, 92, 69, 79, 98, 95, 98, 92, 53, 90, 87}
Find the mean, median, mode, and range of these test scores.
- 2) An automobile dealer is analyzing a frequency table that identifies the number of vehicles of each color sold during the last 6 months. Which measure of data describes the most popular color of vehicle sold?
- A** Mean **B** Median
C Mode **D** Range
- 3) Tom, Rich, Melissa, and Tim competed in a biathlon consisting of biking and swimming events. The table below shows the number of seconds each of them took to complete the parts of the competition.

Name	Biking (seconds)	Swimming (seconds)
Tom	800	550
Rich	825	400
Tim	780	490
Melissa	790	300

The top rankings are awarded to the individuals with the fastest combined times. Based on the information given in the table, which event probably determined the outcome of the biathlon?

- A** Biking, because the times vary more
B Biking, because the times are consistent
C Swimming, because the times vary more
D Swimming, because the times are consistent

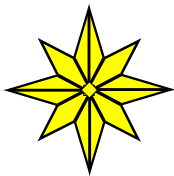
- 4) For each grading period, Mr. Winter gives his students one group project and two exams. The project counts as 40% of the students' final grade, and the mean of the 2 scores counts as the rest of their grade. In Mr. Winter's class, Lisa earned a grade of 92 on the first exam and a grade of 80 on the second exam. Which of the following is a reasonable minimum grade Lisa must score on her project in order to have a final grade of at least 87?
- A 80
B 89
C 90
D 94



ANSWERS TO
TRY IT

- | | |
|---|---------------------------------------|
| 1) Range = 56
Mode = 14 | 2) Range = 45
No mode |
| 3) Mean \approx 17.2
Median = 11.5 | 4) Mean \approx 17.9
Median = 12 |
| 5) B | 6) A |

NOTES



End of Lesson 27

