Nevada DEPARTMENT OF EDUCATION

GRADE

H

Nevada

Instructional Materials

FOR THE

HIGH SCHOOL PROFICIENCY EXAM

HSPE

MATHEMATICS

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KEITH W. RHEAULT
Superintendent of Public Instruction

GLORIA P. DOPF
Deputy Superintendent
Instructional, Research and Evaluative Services

JAMES R. WELLS
Deputy Superintendent
Administrative and Fiscal Services

STATE OF NEVADA

DEPARTMENT OF EDUCATION
700 E. Fifth Street
Carson City, Nevada 89701-5096
(775) 687-9200 · Fax: (775) 687-9101

SOUTHERN NEVADA OFFICE
1820 E. Sahara, Suite 205
Las Vegas, Nevada 89104-3746
(702) 486-6455
Fax: (702) 486-6450

MOODY STREET OFFICE
1749 Moody Street, Suite 40
Carson City, Nevada 89706-2543

Dear Educators,

The following materials, developed as a collaborative effort between the Nevada Department of Education and WestEd, a nonprofit research, development, and service agency, are designed to be used as part of a guided instructional activity to support student performance on assessments. While these materials can provide students with practice in answering assessment items, we believe it is critical that these materials be used to help students understand the elements of the state assessment and to guide them in the use of effective strategies that will support their ability to comprehend and take a variety of assessments. If you choose, however, to use this support document solely as a practice activity, we highly recommend that you go back over each item with students and investigate each response to better understand their knowledge of the assessment.

Types of Items

The math test includes two types of items—multiple choice items for all grades (3rd – 8th and high school) and constructed-response items for grades 4th – 8th. To help prepare students for the constructed-response items we have provided:

1. the student checklist (included in the student test booklet at grades 4 and 5)
2. the general student rubric (included in the student test booklet at grades 6 through 8)
3. item-specific rubrics

With the use of these materials, students can become familiar with the different types of items used on the state assessments. They can learn to use the checklist or rubric to determine if they have answered the constructed-response items completely. Familiarity with the tools provided as part of the assessment and the vocabulary of the standards can result in less anxiety on the part of students. Please note that the student checklist and general rubric can be on the walls of your classroom throughout the school year. As you assign constructed-response items, students can use these tools as they develop their answers. The types of items included in these instructional materials allow for the assessment of different levels of depth of knowledge in the content areas defined by the standards. The different Depth of Knowledge (DOK) levels are explained below. The items are developed so that students can demonstrate mathematical thinking at multiple DOK levels. Teaching students to identify, write, and use different levels of questioning skills as they assess various mathematical concepts will likely lead to improved student achievement on classroom, district, state, and national assessments. We hope that the use of these materials will assist in the creation of students who are powerful mathematical thinkers.

Depth of Knowledge (DOK) Levels

In addition to measuring a broad spectrum of math content domains, the Nevada Proficiency Examination Program in math includes items to assess three Depth of Knowledge levels. These DOK levels are based on descriptions developed by Dr. Norman Webb and adapted for Nevada's mathematics assessments.

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The following are the three DOK levels used on state level assessments in mathematics on Nevada assessments:

DOK 1 - Recall - Items at the DOK Level 1 require the recall of information, such as a fact, definition, term, or simple procedure, as well as performing a simple algorithm, reading an uncomplicated data display, or applying a formula. A one-step, well-defined, and straight algorithmic procedure should be included at DOK Level 1.

DOK 2 - Skills and Concepts - Items at the DOK Level 2 require the engagement of some mental processing beyond a habitual response. The content knowledge or process involved is more complex than in Level 1. Interpreting information from a simple graph or reading information from the graph is at a DOK Level 2. DOK Level 2 activities are not limited only to number skills, but may involve probability skills.

DOK 3 - Strategic Thinking - Items at the DOK Level 3 require students to use reasoning, justifying, planning, using evidence, and a higher level of thinking than the previous two levels. Activities that require students to make conjectures are at this level. The cognitive demands at DOK Level 3 are complex and abstract. The complexity does not result from the fact that there are multiple answers, but because the task requires more demanding reasoning. Some additional DOK Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and deciding which concepts to apply in order to solve a complex non-routine problem.

Math Content Literacy

The Department of Education believes that the breadth and depth of the content and vocabulary of the Nevada Mathematics Content and Achievement indicators present a continuing challenge for instruction at all grade levels. It is not unusual for grade-appropriate, content-specific terminology and vocabulary to be required for instruction prior to these same terms being used on assessments.

Students in Nevada, therefore, must have repeated experiences with **hearing** (oral vocabulary), **reading**, and **writing** the vocabulary of the standards in order to be successful on the state assessment as well as in classroom and district assessments. Make sure that your students know the language of the standards that are being assessed. They should be able to recognize the vocabulary of the standards when you discuss them in class and read them in assessments, and they should be able to effectively use the vocabulary in their writing. This will be especially useful when students are working on the constructed-response items of the state assessment.

We hope that interaction with these instructional support materials will lead to lowered anxiety and better understanding of the assessment tasks being presented to students. If you have questions about the math instructional materials or about how to embed this information into your curriculum, please contact David Brancamp at dbrancamp@doe.nv.gov or call (775) 687-9133, and he will work with you on making these documents beneficial to you and your students.

Cindy Sharp
K–12 CRT/HSPE Consultant
Nevada Department of Education

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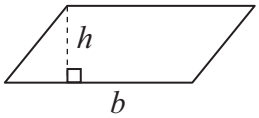
Formula Sheet

Note to Student: You may use these formulas throughout this entire test. Feel free to use this Formula Sheet as needed during your testing time.

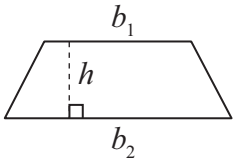
Parallelogram



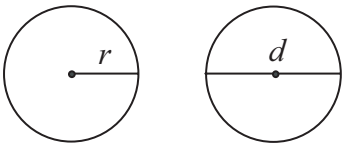
Area $A = bh$

Trapezoid

Area $A = \frac{1}{2}h(b_1 + b_2)$



Circle

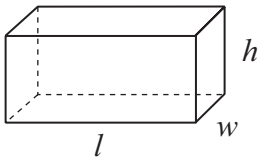


Circumference $C = 2\pi r$

$C = \pi d$

Area $A = \pi r^2$

Rectangular Solid

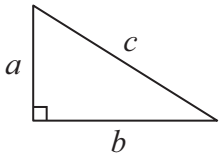


Volume $V = lwh$

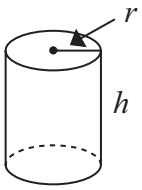
Surface Area $SA = 2lw + 2lh + 2hw$

Pythagorean Theorem

$a^2 + b^2 = c^2$

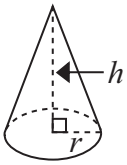


Cylinder



Volume $V = \pi r^2 h$

Cone



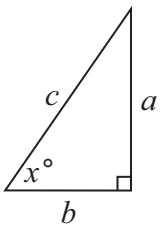
Volume $V = \frac{1}{3}\pi r^2 h$

Trigonometric Ratios

$\sin x = \frac{a}{c}$

$\cos x = \frac{b}{c}$

$\tan x = \frac{a}{b}$



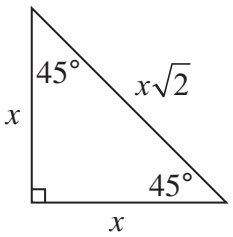
Permutations

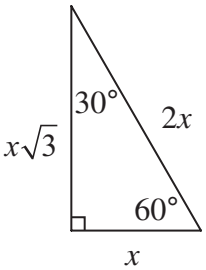
$${}_n\mathrm{P}_k = \frac{n!}{(n-k)!}$$

Combinations

$${}_n\mathrm{C}_k = \frac{n!}{k!(n-k)!}$$

Special Right Triangles





Temperature Formulas

$$°\mathrm{F} = \frac{9}{5}\mathrm{C} + 32$$

$$°\mathrm{C} = \frac{5}{9}(\mathrm{F} - 32)$$

Name: _____

Mathematics
HSPE

This booklet contains mathematics questions for you to answer. The questions in the Test Booklet are all multiple-choice. For each question, you will be given four answer choices—A, B, C, and D. You are to choose the correct answer from the four choices. Each question has only one right answer.

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1 Simplify:

$$\sqrt{3^2 + 3^2}$$

A $2\sqrt{3}$
B $3\sqrt{2}$
C 6
D 9

2 Which equation illustrates the commutative property of addition?

A $(4+x)+3x = 3x+(4+x)$
B $3x(4+x)+0 = 3x(4+x)$
C $(4+x)+3x = 4+(x+3x)$
D $3x(4+x) = 3x(4)+3x(x)$

3 Al, Jim, and Lisa each tutor individual students and small groups of students. The list below shows information about the number of individual students and the number of small groups Al, Jim, and Lisa each tutored this week.

- Al tutored 3 individuals and 2 small groups.
- Jim tutored 5 individuals and 1 small group.
- Lisa tutored 4 individuals and 2 small groups.

Which matrix shows the number of individual students and the number of small groups that Al, Jim, and Lisa tutored this week?

A

$$\begin{array}{r} \\ \text{Individuals} \\ \text{Small Groups} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Al} & \text{Jim} & \text{Lisa} \end{array} \\ \begin{bmatrix} 3 & 2 & 5 \\ 1 & 4 & 2 \end{bmatrix} \end{array}$$

B

$$\begin{array}{r} \\ \text{Individuals} \\ \text{Small Groups} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Al} & \text{Jim} & \text{Lisa} \end{array} \\ \begin{bmatrix} 3 & 5 & 2 \\ 2 & 1 & 4 \end{bmatrix} \end{array}$$

C

$$\begin{array}{r} \\ \text{Individuals} \\ \text{Small Groups} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Al} & \text{Jim} & \text{Lisa} \end{array} \\ \begin{bmatrix} 1 & 2 & 4 \\ 2 & 3 & 5 \end{bmatrix} \end{array}$$

D

$$\begin{array}{r} \\ \text{Individuals} \\ \text{Small Groups} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Al} & \text{Jim} & \text{Lisa} \end{array} \\ \begin{bmatrix} 3 & 5 & 4 \\ 2 & 1 & 2 \end{bmatrix} \end{array}$$

Go On

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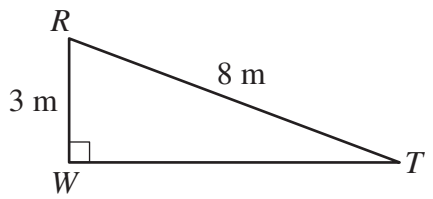
4 Lori has 3 shirts, 2 pairs of pants, and 2 pairs of socks to use to create an outfit. An outfit consists of one shirt, one pair of pants, and one pair of socks. What is the **greatest** number of different outfits Lori can create?

A 4 outfits
B 7 outfits
C 8 outfits
D 12 outfits

5 In right triangle *RTW*, shown below, the length of side $\overline{WR}$ is 3 meters (m), and the length of side $\overline{RT}$ is 8 m.



What is the length of side $\overline{TW}$?

A $\sqrt{5}$ m

B $\sqrt{11}$ m

C $\sqrt{55}$ m

D $\sqrt{73}$ m

6 An equation is shown below.

$$\frac{4x^2-1}{2y} - \frac{9y-5}{3} = z - 3y \quad \text{with } y \neq 0$$

Which is an equivalent equation solved for y ?

A $y = \frac{3(4x^2-1)}{2(3z-5)}$ with $z \neq \frac{5}{3}$

B $y = \frac{2x^2-1}{z+5}$ with $z \neq -5$

C $y = \frac{2x^2-1}{z-5}$ with $z \neq 5$

D $y = \frac{3(4x^2-1)}{2(3z+5)}$ with $z \neq -\frac{5}{3}$

7 To determine what type of music people in a city listen to most often, employees at a radio station polled each person who entered a grocery store between 2:00 P.M. and 5:00 P.M. on Sunday. Which term **best** describes the people who were polled at the grocery store?

A a test
B a sample
C a census
D a statistic

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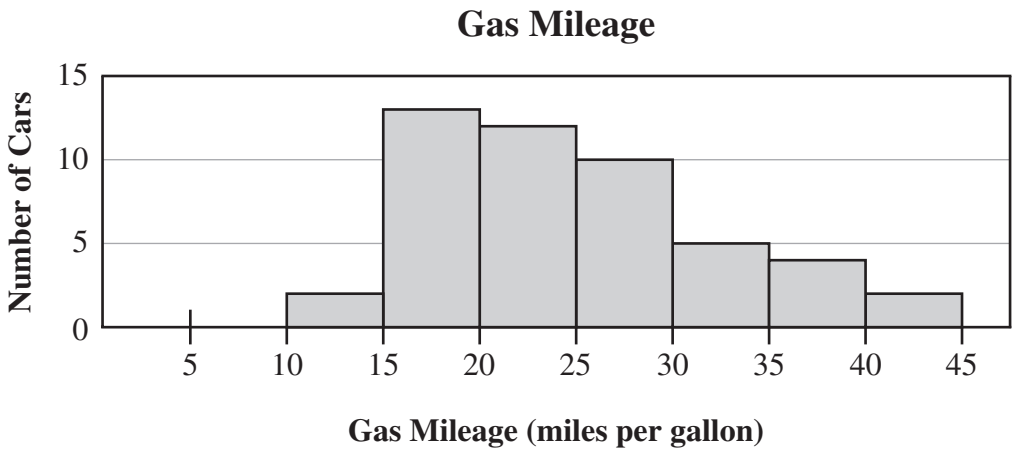
8 Marvin records the gas mileage of 48 different cars. The histogram below displays the data Marvin records.



Based on the histogram, in which range is the **median** gas mileage of the cars?

A 15–20 miles per gallon
B 20–25 miles per gallon
C 25–30 miles per gallon
D 40–45 miles per gallon

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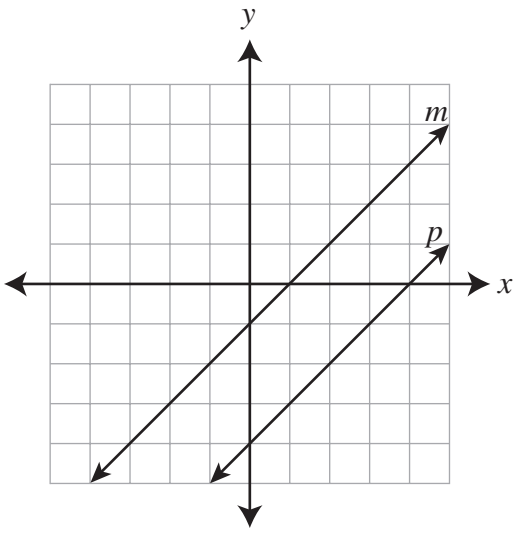
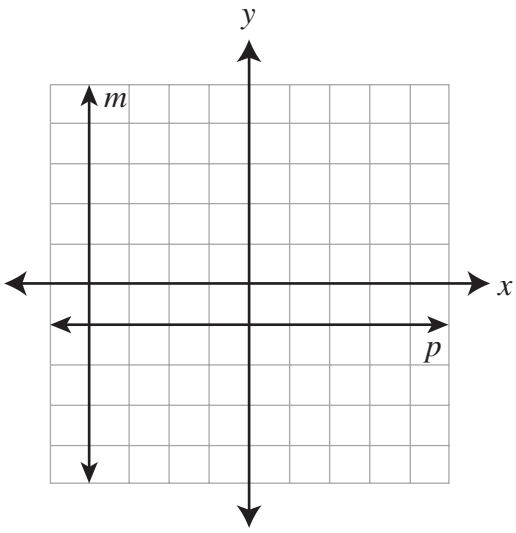
9 In which graph do line *m* and line *p* represent a system of equations that has **no** solution?

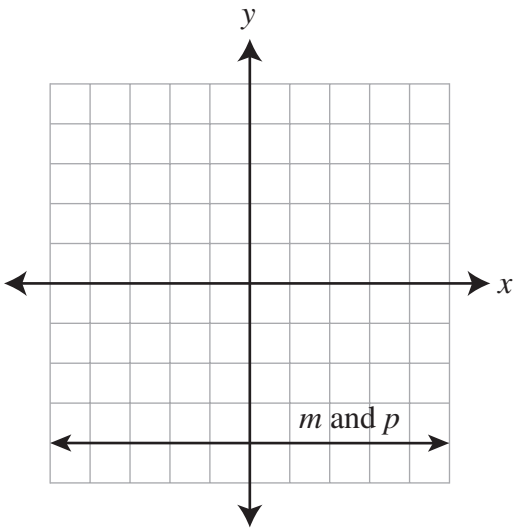
A



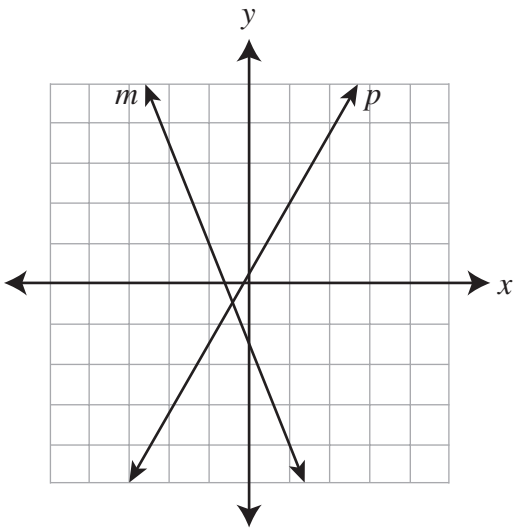
C



B



D



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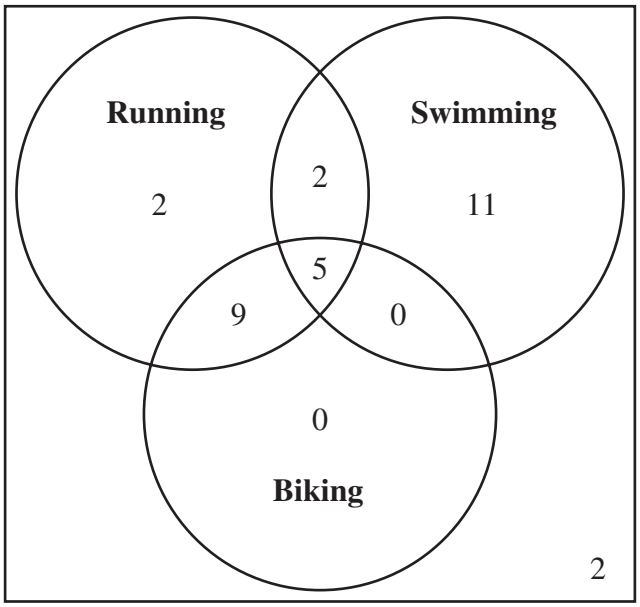
10 Bart is training for a race in which he will run, swim, and bike. The Venn diagram below shows the number of days in July that Bart trained for each part of the race.

Days of Training



Based on the Venn diagram, which statement is true?

A Every day in July that Bart trained for running, he also trained for biking.
B Bart trained for running or swimming every day in July.
C Bart trained for swimming on more days in July than he trained for running.
D Every day in July that Bart trained for biking, he also trained for running.

11 The value of $3\sqrt{180}$ is between which two integers?

A 12 and 15
B 22 and 25
C 39 and 42
D 58 and 61

12 The formula for calculating the volume (V) of a sphere with a given radius (r) is shown below.

$$V = \frac{4}{3}\pi r^3$$

The volume of a sphere is 36π cm^3. What is the **diameter** of the sphere?

A 3 cm
B 6 cm
C $6\sqrt{3}$ cm
D 18 cm

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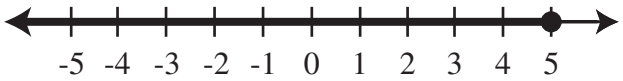
13 Look at the inequality below.

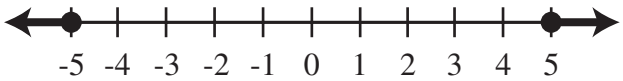
$$|x| \leq 5$$

Which graph represents all of the solutions of the inequality?

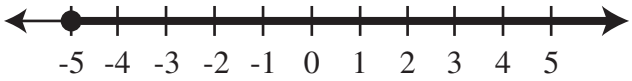
A



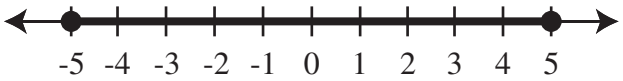
B



C



D



14 There are 200 students in a high school senior class. Of the students in the senior class, 70 are taking physics and 120 are taking chemistry. Of the students in those two groups, 50 are taking both physics and chemistry. What is the probability that a randomly selected senior is taking **neither** physics nor chemistry?

A 0.10
B 0.25
C 0.30
D 0.35

Go On

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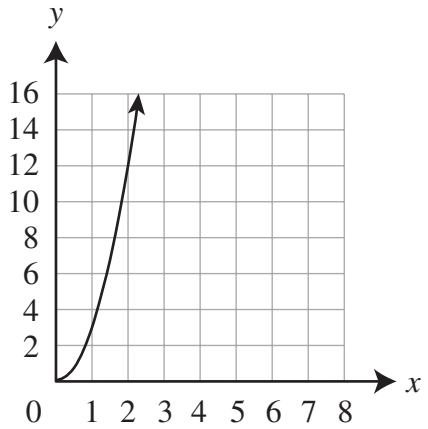
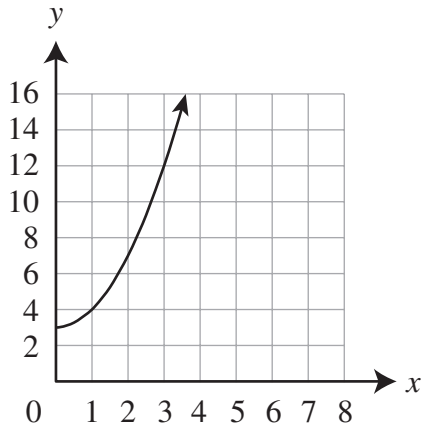
15 A painter is designing a mural. The mural will be shaped like a rectangle. The length of the mural will be 3 times the width of the mural. Which graph shows the relationship between the **width** of the mural (x) and the **area** of the mural (y)?

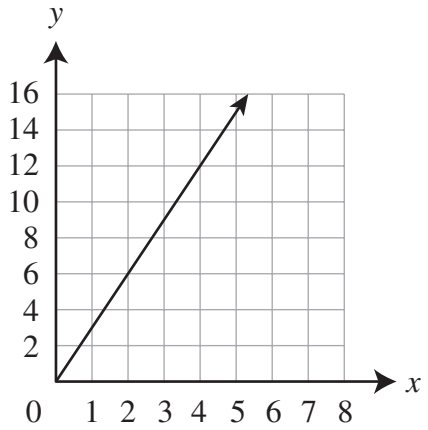
A



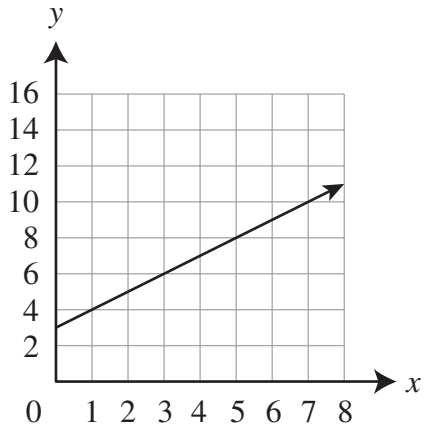
C



B



D



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16 Factor:

$$x^2 - 10x - 24$$

A $(x - 6)(x + 4)$
B $(x - 4)(x + 6)$
C $(x - 2)(x + 12)$
D $(x - 12)(x + 2)$

17 The first four terms of a sequence are shown below.

$$\frac{1}{2} \quad \frac{1}{8} \quad \frac{1}{18} \quad \frac{1}{32}$$

The sequence continues. What is the seventh term of the sequence?

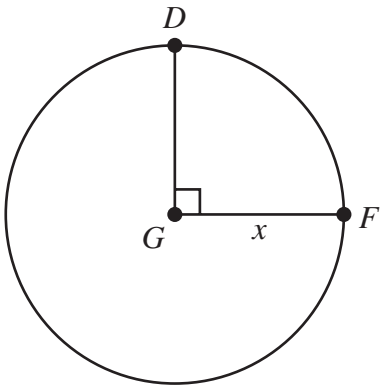
A $\frac{1}{256}$

B $\frac{1}{98}$

C $\frac{1}{64}$

D $\frac{1}{60}$

18 In the diagram below, point D and point F are on circle G .



Which expression describes the length of minor arc DF ?

A $\frac{\pi x}{2}$

B $\frac{\pi x^2}{4}$

C $x\sqrt{2}$

D $x\sqrt{3}$

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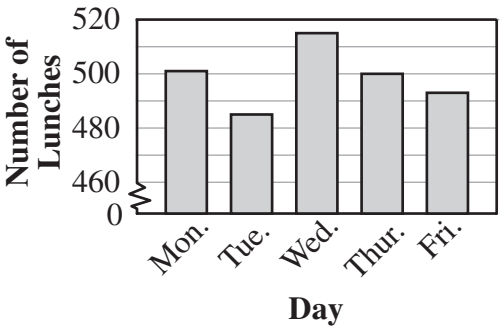
19 A chart and a bar graph are shown below. The chart shows the number of students who purchased a school lunch each day of the week for three weeks. The bar graph represents only part of the data in the chart.

School Lunches

	Mon.	Tue.	Wed.	Thur.	Fri.
Week 1	425	400	476	500	478
Week 2	501	478	404	456	493
Week 3	417	485	515	468	475

School Lunches



Which statement about the bar graph is true?

A The bar graph only represents data from week 1 .
B The bar graph only represents data from week 2 .
C The bar graph represents the least number of students who purchased a school lunch each day of the week for the three weeks.
D The bar graph represents the greatest number of students who purchased a school lunch each day of the week for the three weeks.

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20 Multiply:

$$-3\begin{bmatrix} -1 & 3 \\ 4 & 7 \\ 2 & -2 \end{bmatrix}$$

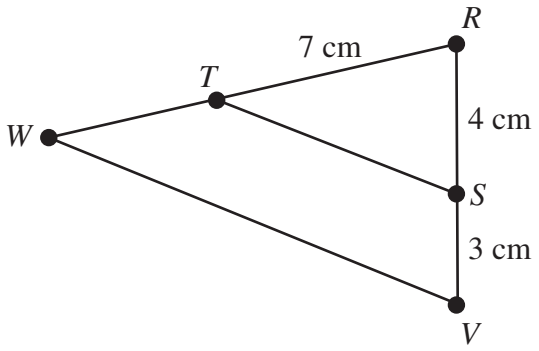
A $\begin{bmatrix} 3 & -9 \\ -12 & -21 \\ -6 & 6 \end{bmatrix}$

B $\begin{bmatrix} 3 & 3 \\ -12 & 7 \\ -6 & -2 \end{bmatrix}$

C $\begin{bmatrix} -1 & 3 \\ -12 & -21 \\ 2 & -2 \end{bmatrix}$

D $\begin{bmatrix} -4 & 0 \\ 1 & 4 \\ -1 & -5 \end{bmatrix}$

21 In the diagram below, triangle *RST* is similar to triangle *RVW* .



What is the length of side $\overline{RW}$?

A 5.25 cm
B 10 cm
C 12.25 cm
D 13 cm

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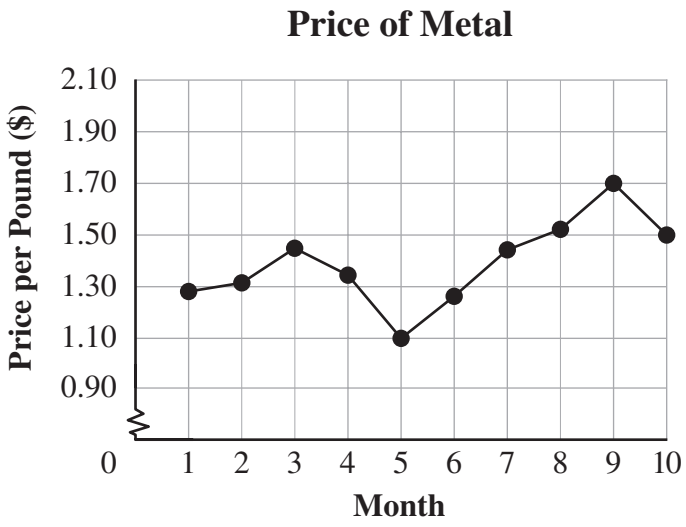
22 The graph below shows the price of one pound of a certain type of metal. The points on the graph represent the price of the metal on the first day of each month.



Based on the graph, what is the **range** of the prices of the metal?

A $0.20
B $0.60
C $1.10
D $1.70

23 A system of equations is shown below.

$$\begin{cases} 2x - 4y = -5 \\ 3x + 5y = 9 \end{cases}$$

What is the solution of the system of equations?

A (2, 2.25)
B (0.5, 1.5)
C (-0.5, 1)
D (-2, 3)

24 Kevin has 5 cubes. Each cube is a different color. Kevin will arrange the cubes side by side in a row. What is the total number of different arrangements of the 5 cubes that Kevin can make?

A 1
B 15
C 25
D 120

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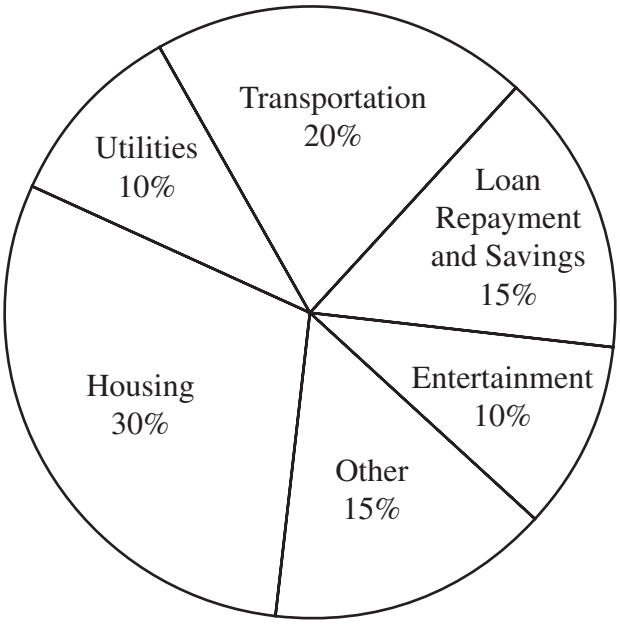
25 The circle graph below shows an average budget for a household in the state where Mario will live.

Average Budget for a Household



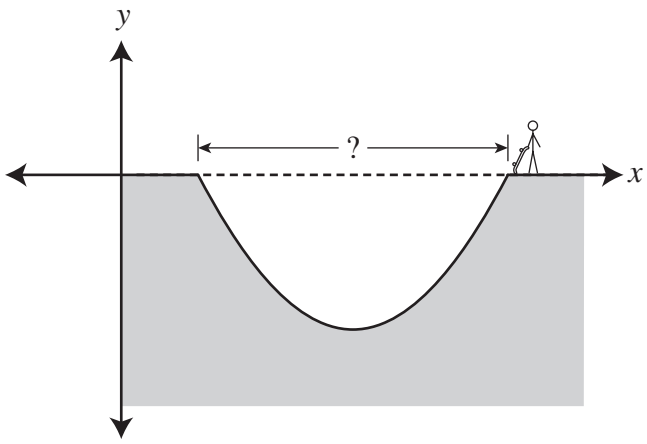
Mario finds an apartment he can rent for $750 per **month**. Based on the circle graph, what is the minimum **annual** salary Mario needs to earn so he can afford to rent the apartment?

A $9,000
B $22,500
C $30,000
D $270,000

26 Fiona is designing a skateboard park. One skating area in the park will be shaped like the parabola that is described by the equation below.

$$y = \frac{1}{6}(x^2 - 18x + 45)$$

A sketch of Fiona's design for the skating area is shown below.



What is the distance across the top of the skating area?

A 12 units
B 14 units
C 15 units
D 18 units

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27 Which integer is **closest** to the value of $\sqrt{5^3}$?

A 3
B 8
C 11
D 15

28 The diameter of each tire produced by a factory is measured in inches (in). Each diameter (x) must be within the range shown below.

$$30.010 \le x \le 30.020$$

What is the tolerance range of the diameter of a tire produced by the factory?

A 30.015 ± 0.005 in
B 30.010 ± 0.010 in
C 30.015 ± 0.010 in
D 30.010 ± 0.015 in

29 Three fair coins are tossed. What is the probability that all three coins land with heads facing up?

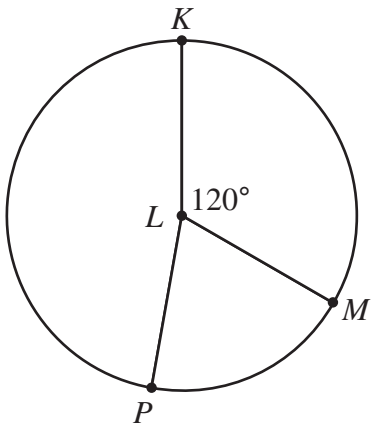
A $\frac{1}{9}$

B $\frac{1}{8}$

C $\frac{1}{6}$

D $\frac{1}{2}$

30 Circle L is shown below.



What is the measure of $\overset{\frown}{KPM}$?

A 60°
B 120°
C 180°
D 240°

31 The first five terms of a sequence are shown below.

4 10 28 82 244

The sequence continues. What is the sixth term of the sequence?

A 368
B 486
C 730
D 732

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32 A system of equations is shown below.

$$\begin{cases} 3x - 2y = 8 \\ -x + 3y = -5 \end{cases}$$

What is the solution of the system of equations?

A (4, 2)

B (2, -1)

C $\left(8, -\frac{5}{2}\right)$

D $\left(\frac{14}{3}, 3\right)$

33 An equation is shown below.

$$T = 2\pi\sqrt{\frac{m}{K}}$$

Which shows the equation correctly solved for m ?

A $m = \frac{KT^2}{4\pi^2}$

B $m = \frac{K\sqrt{T}}{2\pi}$

C $m = \frac{KT^2}{2\pi}$

D $m = K\sqrt{\frac{T}{4\pi}}$

34 Jim bought a new car several years ago and now wants to sell it. Some information about the car is listed below.

- The **new** car cost $30,000 .
- The current value of the car is 27% of the cost of the new car.
- The car is currently in fair condition.
- The cost of repairs needed to put the car in good condition is 8% of the **current** value of the car.
- By repairing the car, Jim will be able to sell it for a price that is 29% of the cost of the new car.

How much money will Jim save by selling the car in its current fair condition instead of repairing the car and selling it in good condition?

A $48
B $188
C $600
D $1,800

35 An equation is shown below.

$$5x^2 = 125$$

What is the solution set of the equation?

A $\{5\}$

B $\{-5, 5\}$

C $\{25\}$

D $\{-12.5, 12.5\}$

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36 A high school principal wants to determine the average amount of time that all students at the high school spend riding school buses each day. Which group of students could be surveyed to get the **least** biased sample?

A students at the bike rack in the afternoon
B students who do not have a driver's license
C students on every sixth bus that arrives at school
D students in one social studies class from each grade

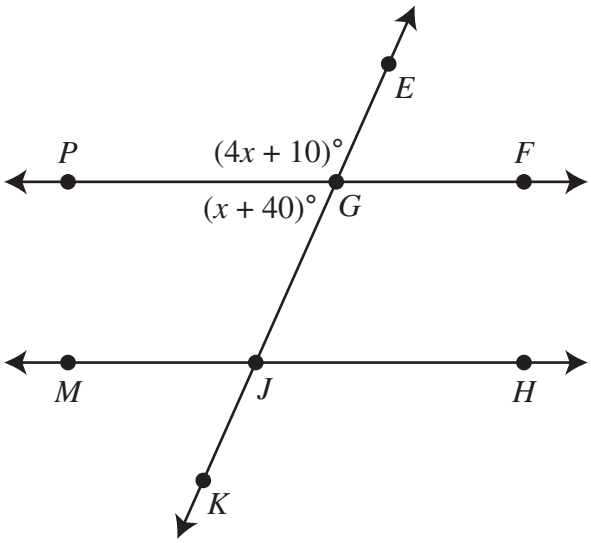
37 The equation below illustrates a property of real numbers.

$$3(7x + 9) = 21x + 27$$

Which property is illustrated by the equation?

A associative property
B commutative property
C distributive property
D identity property

38 In the diagram below, $\overleftrightarrow{PF}$ and $\overleftrightarrow{MH}$ are parallel lines intersected by $\overleftrightarrow{EK}$.



What is the measure of $\angle GJH$?

A 48°
B 50°
C 66°
D 114°

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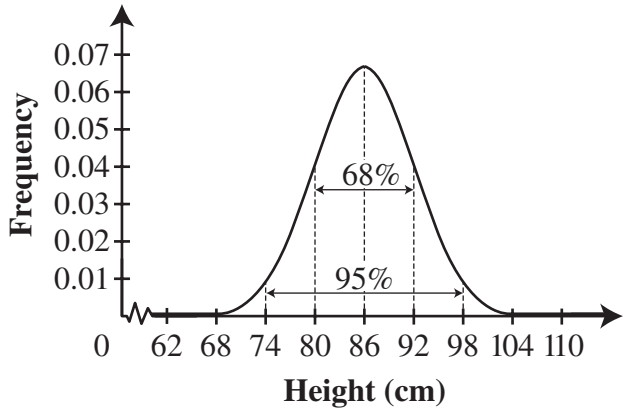
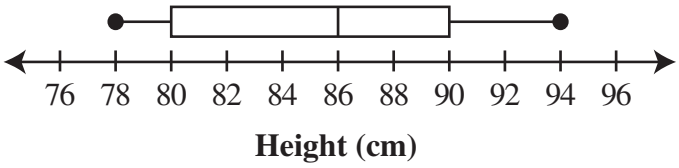
39 A scientist measures the heights of plants growing in two different areas. The normal distribution curve below shows information about the heights of the plants in the first area. The box-and-whisker plot below shows information about the heights of the plants in the second area.

Distribution of Plant Heights in First Area



Distribution of Plant Heights in Second Area



Which statement about the plant heights is **most** likely true?

A The mean height of the plants in each area is the same.
B The percentage of plants between 80 cm and 86 cm in height is the same in each area.
C The first area contains more plants that are exactly 86 cm in height than the second area.
D The percentage of plants that are 86 cm or greater in height is 50% in both areas.

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40 Which of these describes the solutions of the inequality $|3x-4|>5$?

A $x<-3$ or $x>\frac{1}{3}$

B $x<-\frac{1}{3}$ or $x>3$

C $-3<x<\frac{1}{3}$

D $-\frac{1}{3}<x<3$

41 The table below shows the total distance and the number of hours Don rode his bicycle on each of four days.

Don's Bicycle Rides

Day	Distance (miles)	Number of Hours
Monday	38	2.0
Wednesday	33	1.5
Friday	18	0.75
Saturday	45	2.25

Based on the table, on which day did Don ride at the **greatest** average speed?

A Monday
B Wednesday
C Friday
D Saturday

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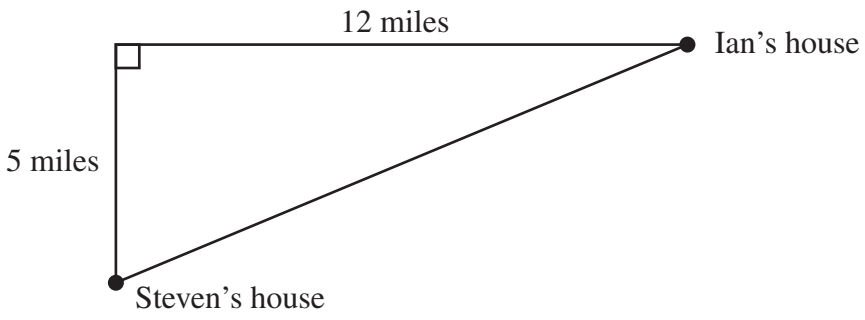
42 There are two routes that may be used to drive from Steven's house to Ian's house. The routes are described below.

- Route 1: Drive 5 miles north and then 12 miles east.
- Route 2: Drive the straight road that goes directly to Ian's house.

The two routes are shown in the diagram below.



How much longer is route 1 than route 2 ?

A 4 miles
B 7 miles
C 13 miles
D 17 miles

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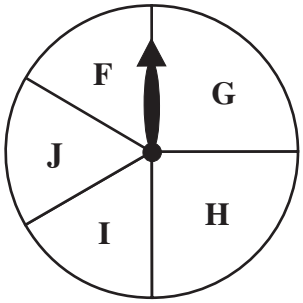
43 A spinner is divided into five sections. Section F, section J, and section I are all the same size. All together, these three sections cover half of the spinner, as shown below.



The arrow on the spinner is spun one time. What is the probability that the arrow stops in section F ?

A $\frac{1}{6}$

B $\frac{1}{5}$

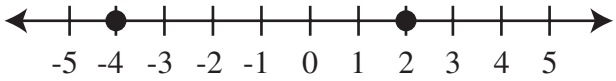
C $\frac{1}{4}$

D $\frac{1}{3}$

44 Maya swims in a pool that is 75 feet long. She swims the length of the pool 20 times each day. At this rate, about how many days will it take Maya to swim a total distance of 1 mile? (1 mile = 5,280 feet)

A 1 day
B 4 days
C 56 days
D 70 days

45 The graph below represents the solution set of an equation.



Which of these is the equation?

A $|x| = 2$

B $|x| = 4$

C $|x+1| = 3$

D $|x+4| = 0$

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46 Which equation shows the use of the inverse property of multiplication?

A $7x \bullet \frac{1}{7x} = 1$

B $7x \bullet 1 = 7x$

C $7x \bullet 0 = 0$

D $7x \bullet \frac{1}{7} = \frac{1}{7} \bullet 7x$

47 A person is 7 feet tall. In which group is the person's height **not** likely an outlier when compared to the heights of all the other people in the group?

A a children's singing group
B a men's professional basketball team
C a middle school math class
D a women's professional gymnastics team

48 The table below shows the total amount a repair company charges for five different jobs based on the number of hours each job takes to complete.

Repair Company Charges

Number of Hours to Complete Job	Total Amount Charged ($)
3	195
5	275
12	555
16	715
19	835

The relationship between the number of hours a job takes to complete and the total amount the repair company charges continues. What is the least number of hours the repair company could take to complete a job and charge a total amount that is **greater** than $5,000 ?

A 77 hours
B 114 hours
C 124 hours
D 126 hours

Go On

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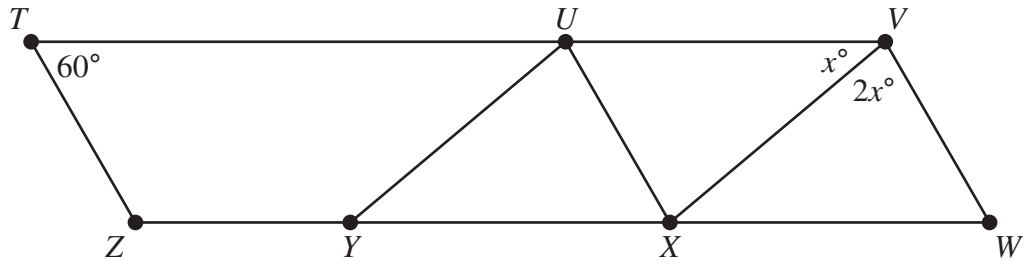
49 In the figure below, $\overline{TV} \parallel \overline{ZW}$, $\overline{UY} \parallel \overline{VX}$, $\overline{UX} \parallel \overline{VW}$, and $\overline{TZ} \parallel \overline{VW}$.



What is the measure of $\angle ZYU$?

A 80°
B 100°
C 120°
D 140°

50 Terra takes four different measurements of the length of her calculator. Terra's four measurements are listed below.

14.8 cm 15 cm 148.6 mm 149 mm

Which measurement is the **most** precise?

A 14.8 cm
B 15 cm
C 148.6 mm
D 149 mm

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You may want to go back and check your answers or answer questions you did not complete.

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GRADE H

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Appendix I

Scoring Support Materials

HSPE

MATHEMATICS

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Correct Answers for Multiple-choice Items

Item Number	Correct Answer	Content Cluster	DOK
1	B	C1	1
2	A	C1	1
3	D	C5	1
4	D	C5	2
5	C	C4	1
6	A	C2	2
7	B	C5	1
8	B	C5	2
9	A	C4	1
10	D	C4	3
11	C	C1	2
12	B	C3	2
13	D	C2	1
14	C	C5	3
15	A	C2	2
16	D	C2	1
17	B	C2	2
18	A	C4	2
19	D	C5	2
20	A	C1	1
21	C	C4	2
22	B	C5	1
23	B	C2	2
24	D	C5	2
25	C	C3	2

Item Number	Correct Answer	Content Cluster	DOK
26	A	C2	2
27	C	C1	2
28	A	C3	2
29	B	C5	2
30	D	C4	1
31	C	C2	2
32	B	C2	2
33	A	C2	1
34	A	C3	3
35	B	C2	1
36	D	C5	2
37	C	C1	1
38	C	C4	2
39	D	C5	3
40	B	C2	2
41	C	C3	2
42	A	C4	2
43	A	C5	1
44	B	C3	2
45	C	C2	2
46	A	C1	1
47	B	C5	2
48	C	C2	3
49	D	C4	3
50	C	C3	1

Detailed objectives for Content Standards and Depth of Knowledge (DOK) descriptions can be found on the Nevada Department of Education Website.

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Appendix II

Administrative Support Materials

HSPE

MATHEMATICS

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Name: _____

Answer Document

Mathematics

| | | |

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H

Nevada Department of Education

Keith W. Rheault
Superintendent of Public Instruction

Office of Assessment, Program Accountability, and Curriculum
775-687-9188

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