



# Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

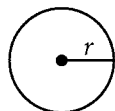
## DIRECTIONS

For questions 1-30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding bubble on your answer sheet. For questions 31-38, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

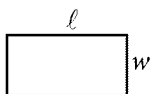
1. The use of a calculator **is not permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

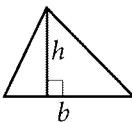


$$A = \pi r^2$$

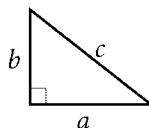
$$C = 2\pi r$$



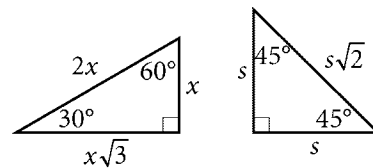
$$A = \ell w$$



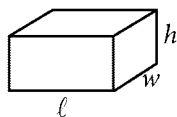
$$A = \frac{1}{2}bh$$



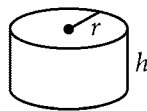
$$c^2 = a^2 + b^2$$



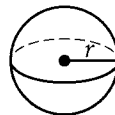
Special Right Triangles



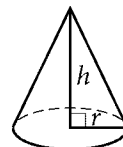
$$V = \ell wh$$



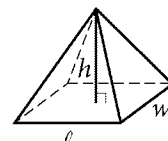
$$V = \pi r^2 h$$



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



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



$$V = \frac{1}{3}\ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is  $2\pi$ .

The sum of the measures in degrees of the angles of a triangle is 180.



1

A sample of water was taken from each of ten different locations in a pond. The pH of each sample was measured. The measurements are summarized in the frequency table shown.

pH	Frequency
6.8 to 7.0	1
7.1 to 7.3	2
7.4 to 7.6	4
7.7 to 7.9	3

How many samples have a pH of 7.4 or greater?

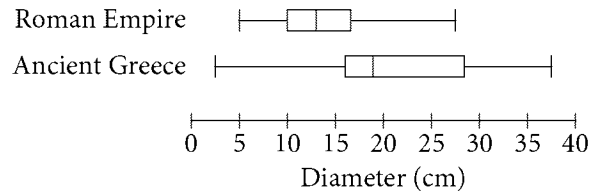
- A) 3
- B) 4
- C) 6
- D) 7

2

In 2015, the city of Miami had a population of 441,000 people and an area of 36 square miles. What was the population density of Miami, in people per square mile, in 2015?

- A) 10,750
- B) 12,250
- C) 14,250
- D) 16,750

3



The Metropolitan Museum of Art has plates on display from the Roman Empire and ancient Greece. The box plots shown summarize the distributions of the diameters, in centimeters, of all the museum's plates from each region. How does the median diameter of the plates from the Roman Empire,  $r$ , compare to the median diameter of the plates from ancient Greece,  $g$ ?

- A)  $r < g$
- B)  $r > g$
- C)  $r = g$
- D) There is not enough information to compare the medians.

4

The combustion of glucose releases energy. The ratio of grams of glucose combusted to kilocalories of energy released is 12.0 to 45.0. How many grams of glucose must be combusted to provide 85.5 kilocalories of energy?

- A) 5.7
- B) 9.9
- C) 22.8
- D) 320.6



5

The function  $f$  is defined by  $f(x) = x^2 - 7$ . What is the value of  $f(3)$  ?

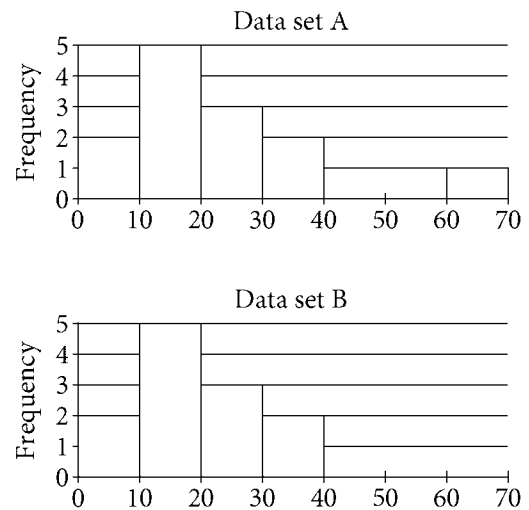
- A)  $-16$
- B)  $-2$
- C)  $2$
- D)  $16$

6

The probability of an unfair coin landing heads side up is  $0.6$ . A student tossed this coin into the air 9 times. It landed tails side up 5 times and heads side up 4 times. What is the probability that the coin will land heads side up on the 10th toss?

- A)  $0.4$
- B)  $0.5$
- C)  $0.6$
- D)  $1$

7



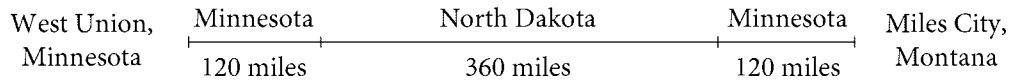
The two histograms show the distribution of data set A and data set B, respectively. Data set B is the result of removing the outlier from data set A. Which of the following statements about the means of data set A and data set B is true?

- A) The means of data set A and B are the same.
- B) The mean of data set A is greater than the mean of data set B.
- C) The mean of data set A is less than the mean of data set B.
- D) No comparison about the means of the data sets can be made.



Questions 8 and 9 refer to the following information.

Haimi drove a car from West Union, Minnesota, through North Dakota, to Miles City, Montana. The total distance she traveled through each state is shown in the figure.



The distance  $d$ , in miles, Haimi drove as a function of the time  $t$ , in hours, since she started driving is modeled by the equation  $d = 60t$ .

8

According to the model, what distance, in miles, had Haimi driven 3 hours after she started driving?

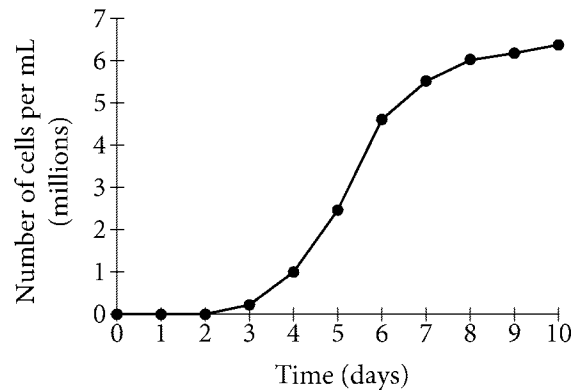
- A) 20
- B) 60
- C) 120
- D) 180

9

What interval represents all values of  $t$  during which Haimi drove in North Dakota?

- A)  $2 \leq t \leq 10$
- B)  $2 \leq t \leq 8$
- C)  $0 \leq t \leq 8$
- D)  $0 \leq t \leq 2$

10



The graph shows the number of algae cells grown during an experiment, in millions of cells per milliliter (mL) of water,  $d$  days after the start of an experiment. Between which two days was the growth rate, in millions of cells per mL of water per day, of the algae the greatest?

- A) Day 4 and day 5
- B) Day 5 and day 6
- C) Day 7 and day 8
- D) Day 9 and day 10



11

A local restaurant gives teachers a 20% discount on all their meals. If a teacher pays \$14.00 for a meal after the discount was applied, what was the price of the meal before the discount?

- A) \$16.80
- B) \$17.50
- C) \$20.00
- D) \$25.20

12

Amount of Water  
in 80 Bottles

Fluid ounces	Frequency
19.6	1
19.7	0
19.8	12
19.9	10
20.0	31
20.1	14
20.2	11
20.3	1
20.4	0

The frequency table above shows the distribution of the actual number of fluid ounces of water in a random sample of 80 20-ounce bottles of the water at a bottling plant. Bottles are only sold if they contain at least 19.8 but no more than 20.2 fluid ounces of water. If the proportion of bottles that can be sold is the same for the sample and the 16,000 20-ounce bottles produced at the plant each day, how many of the 16,000 bottles cannot be sold?

- A) 800
- B) 600
- C) 400
- D) 200

13

$x$	$f(x)$
-4	14
-2	8
3	-7
5	-13

For the linear function,  $f$ , the table shows several values of  $x$  and their corresponding values of  $f(x)$ . What is the  $y$ -intercept of the graph of  $y = f(x)$  in the  $xy$ -plane?

- A)  $(0, -3)$
- B)  $(0, -1)$
- C)  $(0, 2)$
- D)  $(0, 4)$



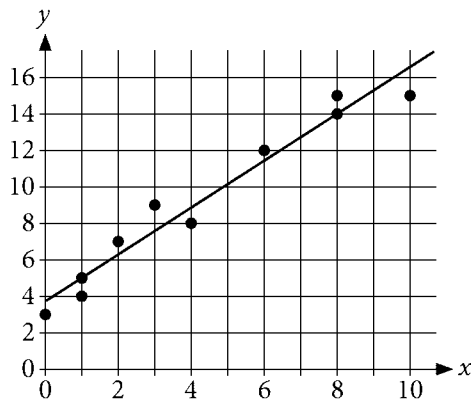
14

When a buffet restaurant charges \$12.00 per meal, the number of meals it sells per day is 400. For each \$0.50 increase to the price per meal, the number of meals sold per day decreases by 10. What is the price per meal that results in the greatest sales, in dollars, from meals each day?

- A) \$16.00
- B) \$20.00
- C) \$24.00
- D) \$28.00

15

The scatterplot shows the relationship between two variables,  $x$  and  $y$ . A line of best fit is also shown.



What is an equation of the line of best fit?

- A)  $y = 3.7 + 1.3x$
- B)  $y = 1.3 + 3.7x$
- C)  $y = 3.7 - 1.3x$
- D)  $y = 1.3 - 3.7x$

16

For the linear function  $f$ ,  $f(2) = 10$  and the graph of  $y = f(x)$  in the  $xy$ -plane has a slope of 3. Which equation defines  $f$ ?

- A)  $f(x) = 2x + 12$
- B)  $f(x) = 2x + 8$
- C)  $f(x) = 3x + 10$
- D)  $f(x) = 3x + 4$

17

If  $7x + 21 = -2$ , what is the value of  $x + 3$ ?

- A)  $-5$
- B)  $-2$
- C)  $-\frac{5}{7}$
- D)  $-\frac{2}{7}$



18

$$\begin{aligned}x + 2y &= 10 \\ 2x - y &= 5\end{aligned}$$

The solution to the given system of equations is  $(x, y)$ . What is the value of  $3x + y$  ?

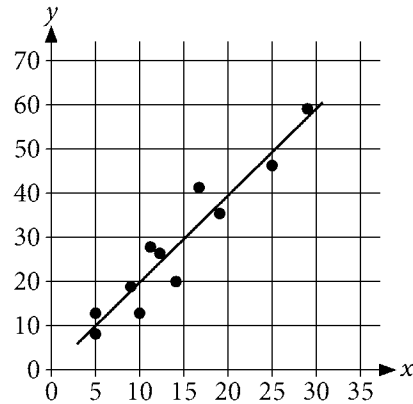
- A) 5
- B) 7
- C) 13
- D) 15

19

An advertising agency guarantees that its services will increase website traffic by 3.5% compared to each previous week. Which type of function best models the weekly guaranteed website traffic as the number of weeks increases?

- A) Increasing exponential
- B) Decreasing exponential
- C) Increasing linear
- D) Decreasing linear

20



The scatterplot shows a data set of 11 points and a line of best fit for the data. For how many data points is the  $y$ -value predicted by the line of best fit greater than the actual  $y$ -value?

- A) Five
- B) Six
- C) Seven
- D) Eight

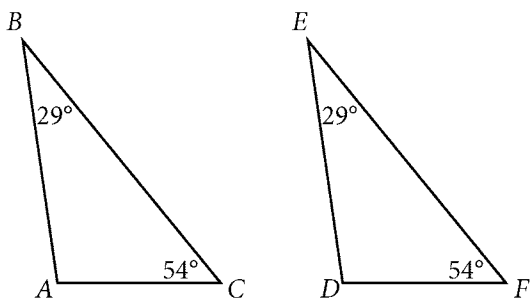
21

Dana is riding in a 100-mile-long bicycle race. The function  $f$  defined by  $f(x) = 100 - 18x$  models the number of miles that Dana has remaining  $x$  hours after she starts the race. What is the best interpretation of  $f(2) = 64$  ?

- A) Dana rides about 64 miles in the first 2 hours of the race.
- B) Dana will ride the last 64 miles of the race in about 2 hours.
- C) When Dana has ridden 64 miles, she has about 2 hours remaining.
- D) Two hours after Dana starts the race, she has about 64 miles remaining.



22



Triangle  $ABC$  and Triangle  $DEF$  each have an angle measuring  $29^\circ$  and an angle measuring  $54^\circ$ , as shown above. Which of the following statements is sufficient to prove triangle  $ABC$  is congruent to triangle  $DEF$ ?

- A) The length of  $\overline{EF}$  is 10.
- B) The measure of angle  $EDF$  is  $97^\circ$ .
- C) The length of  $\overline{BC}$  is equal to the length of  $\overline{EF}$ .
- D) The measure of angle  $BAC$  is equal to the measure of angle  $EDF$ .

23

How many solutions does the equation  $|x + 7| = -4$  have?

- A) Zero
- B) Exactly one
- C) Exactly two
- D) More than two

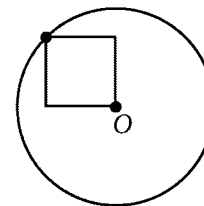
24

$$3x^2 + x - 2 = 0$$

The solutions to the quadratic equation above are  $a$  and  $b$ . What is the value of  $a + b$ ?

- A)  $-\frac{5}{3}$
- B)  $-\frac{1}{3}$
- C)  $\frac{1}{3}$
- D)  $\frac{5}{3}$

25



In the figure shown, point  $O$  is the center of the circle. One vertex of the square lies on the circle, and the opposite vertex is point  $O$ . If the area of the shaded region is  $36\pi - 18$ , what is the perimeter of the square?

- A) 24
- B) 72
- C)  $12\sqrt{2}$
- D)  $36\sqrt{2}$





26

Which of the following is equivalent to the expression  $x^4 - 8x^2 + 16$  ?

I.  $(x + 2)^2(x - 2)^2$

II.  $(x^2 - 4)^2$

- A) I only
- B) II only
- C) I and II
- D) Neither I nor II

27

Each year the value of an investment increases by 2.5% of the previous year's value. The initial value of the investment was \$500. Which equation gives the value of the investment  $y$ , in dollars,  $x$  years after the initial investment was made?

- A)  $y = 500(0.25)^x$
- B)  $y = 500(1.025)^x$
- C)  $y = 500(1.25)^x$
- D)  $y = 500(2.5)^x$

28

$$\begin{aligned}5x - y &= 9 \\ -60x + 12y &= -108\end{aligned}$$

How many solutions does the given system of equations have?

- A) Zero
- B) Exactly one
- C) Exactly two
- D) Infinitely many



29

Bridges have spaces between their sections to allow for expansion and contraction caused by temperature variation. This space is known as the gap width. The size of the gap width  $w(T)$ , in inches, is a linear function of temperature  $T$ , in degrees Fahrenheit ( $^{\circ}\text{F}$ ). For a certain bridge, the gap width is 2.875 inches at  $40^{\circ}\text{F}$  and is 1.875 inches at  $100^{\circ}\text{F}$ . Which of the following defines the relationship between temperature and gap width?

- A)  $w(T) = -\frac{1}{60}(T - 40) + 2.875$
- B)  $w(T) = -\frac{1}{60}(T + 40) - 2.875$
- C)  $w(T) = 60(T - 40) + 2.875$
- D)  $w(T) = 60(T + 40) - 2.875$

30

The number of books in a library increased by 30% from 2002 to 2014. There were  $x$  books in the library in 2002. Which expression represents the number of books in the library in 2014 in terms of  $x$  ?

- A)  $130x$
- B)  $30x$
- C)  $1.3x$
- D)  $0.3x$


**DIRECTIONS**

For questions 31-38, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

- Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the bubbles accurately. You will receive credit only if the bubbles are filled in correctly.
- Mark no more than one bubble in any column.
- No question has a negative answer.
- Some problems may have more than one correct answer. In such cases, grid only one answer.
- Mixed numbers** such as  $3\frac{1}{2}$  must be gridded as 3.5 or  $7/2$ . (If  $\begin{array}{|c|c|c|} \hline 3 & 1 & 2 \\ \hline \end{array}$  is entered into the grid, it will be interpreted as  $\frac{31}{2}$ , not  $3\frac{1}{2}$ .)
- Decimal answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

Write answer in boxes. →

Answer:  $\frac{7}{12}$  are:

7	/	1	2
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
<input checked="" type="radio"/>	7	7	7
8	8	8	8
9	9	9	9

← Fraction line

Grid in result.

Answer: 2.5

	2	.	5
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	3
4	4	4	4
5	5	5	<input checked="" type="radio"/>
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

← Decimal point

Acceptable ways to grid  $\frac{2}{3}$  are:

	2	/	3
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	0	0	0
1	1	1	1
2	<input checked="" type="radio"/>	2	2
3	3	3	<input checked="" type="radio"/>
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	6
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
7	7	7	7
8	8	8	8
9	9	9	9

.	6	6	7
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	<input checked="" type="radio"/>	<input checked="" type="radio"/>	6
7	7	7	<input checked="" type="radio"/>
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

	2	0	1
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	0	<input checked="" type="radio"/>	0
1	1	1	<input checked="" type="radio"/>
2	<input checked="" type="radio"/>	2	2

2	0	1	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input checked="" type="radio"/>	0	0
1	1	<input checked="" type="radio"/>	1
<input checked="" type="radio"/>	2	2	2

**NOTE:**

You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.



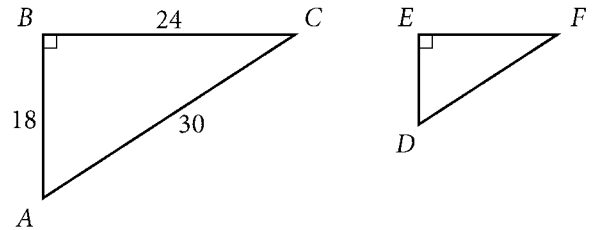
31

In a survey of 240 television viewers,  $\frac{3}{5}$  indicated that they like comedies, some indicated that they do not like comedies, and the rest did not respond. If one of the 240 viewers is selected at random, the probability is  $\frac{1}{15}$  that the viewer selected did not respond. How many of the 240 viewers indicated that they do not like comedies?

32

What is the  $y$ -coordinate of the  $y$ -intercept of the graph of  $y = 3^x + 9$  ?

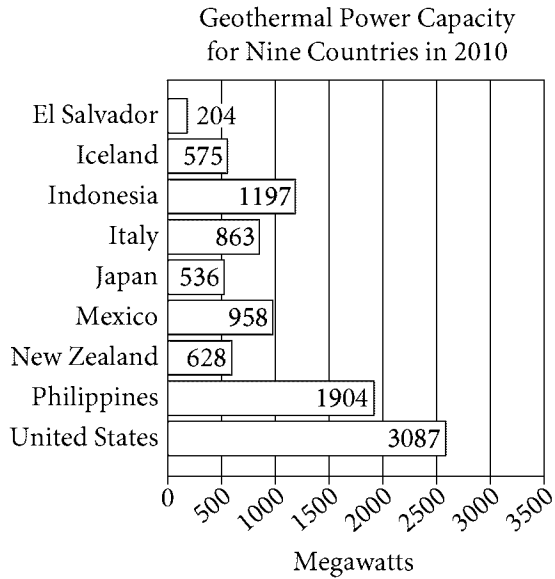
33



Triangle  $ABC$  is similar to triangle  $DEF$ , where angle  $A$  corresponds to angle  $D$ . What is the value of  $\cos F$  ?

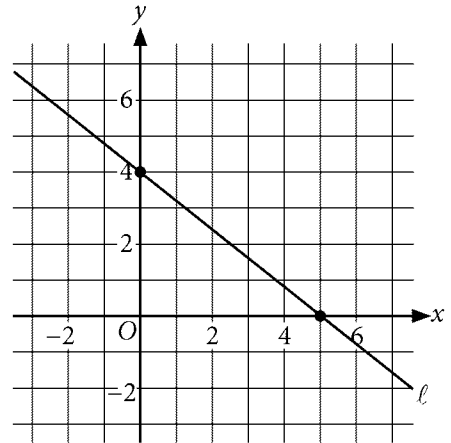


34



The graph shows the power capacity for the nine countries that had the greatest geothermal power capacity in 2010. What was the capacity, in megawatts, of the country that had the median capacity of the nine countries?

35



Line  $\ell$  is shown in the  $xy$ -plane, and the point with coordinates  $(2, c)$  is on line  $\ell$ . What is the value of  $c$ ?



Questions 36 and 37 refer to the following information.

The table gives the typical adult weight ranges and life spans for African and Asian elephants in the wild.

	African elephant	Asian elephant
Typical minimum weight (tons)	2.50	2.25
Typical maximum weight (tons)	7.00	5.50
Typical life span (years)	70	60

36

Based on the table, what is the typical minimum weight of an adult African elephant in the wild, in pounds? (1 ton = 2000 pounds)

37

Based on the table, the typical life span of the African elephant in the wild is  $p\%$  greater than the typical life span of the Asian elephant in the wild. What is the value of  $p$ ? (Disregard the % sign when entering your answer. For example, if your answer is 39%, enter 39)

38

$x$	$f(x)$
2	106
3	151
4	196

The table shows several values of  $x$  and their corresponding values of  $f(x)$ . The function  $f$  is defined by  $f(x) = mx + b$ , where  $m$  and  $b$  are constants. What is the value of  $b$ ?

# STOP

**If you finish before time is called, you may check your work on this section only.  
Do not turn to any other section.**