



# Math Test – Calculator

45 MINUTES, 31 QUESTIONS

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

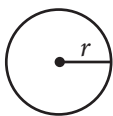
## DIRECTIONS

For questions 1-27, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 28-31, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 28 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

## NOTES

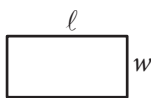
1. The use of a calculator **is permitted**.
2. All variables and expressions used represent real numbers unless otherwise indicated.
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function  $f$  is the set of all real numbers  $x$  for which  $f(x)$  is a real number.

## REFERENCE

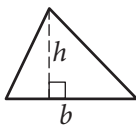


$$A = \pi r^2$$

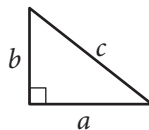
$$C = 2\pi r$$



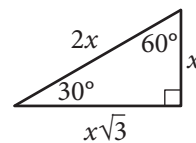
$$A = \ell w$$



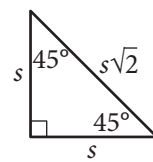
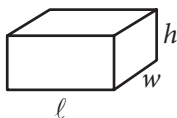
$$A = \frac{1}{2}bh$$



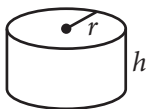
$$c^2 = a^2 + b^2$$



Special Right Triangles



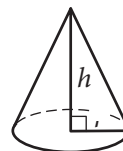
$$V = \ell wh$$



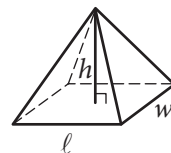
$$V = \pi r^2 h$$



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



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



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

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

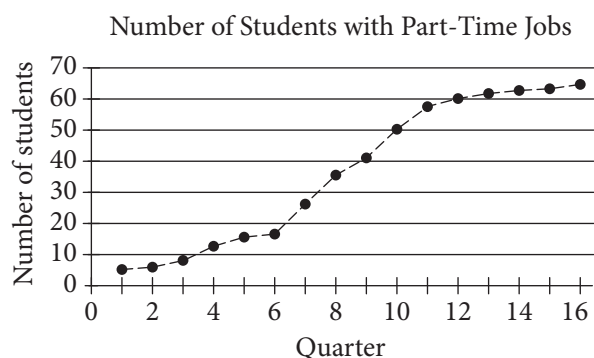
The number of radians of arc in a circle is  $2\pi$ .

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



1

A high school counselor conducted a study over 16 consecutive quarters to determine the number of students with part-time jobs. Each student in the 2014 graduating class is surveyed once per quarter for all four years of high school. The graph below shows the data for each quarter the survey was conducted.



During which of the following periods is the increase in the number of students with part-time jobs largest?

- A) Quarters 4 through 6
- B) Quarters 7 through 10
- C) Quarters 11 through 14
- D) Quarters 13 through 16

2

Eli saves money each month to buy a new computer. The total amount he has saved,  $T$ , can be calculated by the equation  $T = 83 + 30m$ , where  $m$  is the number of months since he started saving. What does the number 83 represent in the equation?

- A) The amount of money Eli started with
- B) The number of months Eli has been saving
- C) The amount of money Eli saves each month
- D) The total amount of money Eli wants to save

3

According to the Department of Agriculture, consuming 100 grams of banana provides 0.15 milligram of zinc. Which of the following is closest to the number of milligrams of zinc provided by 140 grams of banana?

- A) 0.15
- B) 0.21
- C) 0.25
- D) 0.93

4

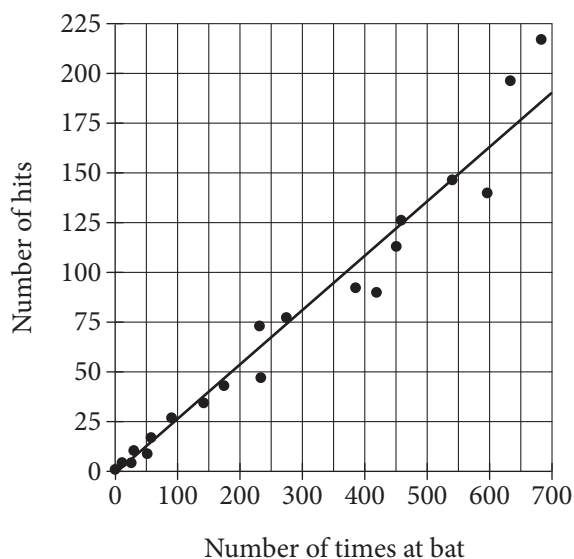
When the equation  $y = 5x + p$ , where  $p$  is a constant, is graphed in the  $xy$ -plane, the line passes through the point  $(-2, 1)$ . What is the value of  $p$ ?

- A) -9
- B) -2
- C) 3
- D) 11



Questions 5 and 6 refer to the following information.

The Number of Hits  
and Times at Bat by Players on  
a Major League Baseball Team



The scatterplot above shows the number of hits and the number of times at bat by each of 20 players on a major league baseball team. The line of best fit for the data is also shown.

5

Which of the following statements about the relationship between the number of times at bat and the number of hits is true?

- A) As the number of times at bat increases, the number of hits decreases.
- B) As the number of times at bat increases, the number of hits increases.
- C) As the number of times at bat increases, the number of hits remains constant.
- D) As the number of times at bat decreases, the number of hits increases.

6

For the player with 450 times at bat, the actual number of hits the player had is approximately how many fewer than the number of hits predicted by the line of best fit?

- A) 10
- B) 20
- C) 30
- D) 40



7

An advertisement states that the printing rate of a certain printer is 400 characters per second. According to the convention that 1 word consists of 5 characters, what would be the advertised printing rate, in words per minute?

- A) 2,000
- B) 4,800
- C) 24,000
- D) 120,000

8

| Year   | 0      | 1      | 2      | 3      | 4      |
|--------|--------|--------|--------|--------|--------|
| Salary | 38,000 | 39,140 | 40,314 | 41,524 | 42,769 |

The table above shows the yearly salary, in dollars, of an employee at a company. Which of the following best describes the type of model that fits the data in the table?

- A) Linear, increasing by approximately \$1,140 per year
- B) Linear, increasing by approximately \$1,245 per year
- C) Exponential, increasing by approximately 3% each year
- D) Exponential, increasing by approximately 9% each year

9

$$(x^2y - 3y^2 + 5xy^2) - (-x^2y + 3xy^2 - 3y^2)$$

Which of the following is equivalent to the expression above?

- A)  $2x^2y + 2xy^2$
- B)  $8xy^2 - 6y^2$
- C)  $2x^2y + 8xy^2 - 6y^2$
- D)  $x^4y^2 + 9xy^4 - 15xy^2$

10

$$4x - \frac{1}{2}x - 7 = 7\left(\frac{1}{2}x - 7\right)$$

Which of the following describes the solution to the equation above?

- A)  $x = 0$
- B)  $x = 10\frac{1}{2}$
- C) The equation has infinitely many solutions.
- D) The equation has no solutions.



11

The table below shows the monthly electricity bills of Joseph and Samuel for the first five months of a year.

Electricity Bills

| Month    | Joseph   | Samuel   |
|----------|----------|----------|
| January  | \$184.66 | \$188.99 |
| February | \$193.12 | \$181.27 |
| March    | \$175.99 | \$176.35 |
| April    | \$145.30 | \$149.23 |
| May      | \$180.33 | \$185.66 |

Based on the information in the table, which of these statements is true about the ranges and medians of the bills?

- A) Both the range and median of Joseph's bills are less than the range and median of Samuel's bills.
- B) Both the range and median of Joseph's bills are greater than the range and median of Samuel's bills.
- C) The range of Joseph's bills is less than the range of Samuel's bills, while the median of Joseph's bills is greater than the median of Samuel's bills.
- D) The range of Joseph's bills is greater than the range of Samuel's bills, while the median of Joseph's bills is less than the median of Samuel's bills.

12

Cars in Service on a Railroad

|               | In service less than 10 years | In service 10 or more years |
|---------------|-------------------------------|-----------------------------|
| Single level  | 215                           | 497                         |
| Double-decker | 16                            | 82                          |

The table above presents information about the 810 train cars in service on a railroad.

Approximately what percentage of the train cars in service are double-decker cars that have been in service for less than 10 years?

- A) 2 percent
- B) 7 percent
- C) 10 percent
- D) 16 percent



13

A moving company uses plastic wrap to bundle groups of boxes together. If a portion of plastic wrap that measures 900 inches in length is used to bundle each group of boxes, how many groups of boxes can be bundled using 1,500 feet of the same type of plastic wrap?

- A) 15
- B) 20
- C) 25
- D) 30

14

The table below shows the number of calories in a cheeseburger at six different restaurants.

Calories in a Cheeseburger

| Restaurant      | Calories |
|-----------------|----------|
| Blue Jay        | 810      |
| Clear Lake Cafe | 900      |
| Molly's         | 740      |
| Riverside Diner | 1,120    |
| Maya's Bistro   | 1,050    |
| Tom's Place     | 700      |

What is the difference in the number of calories in a cheeseburger at the Riverside Diner and the median number of calories in cheeseburgers at all six restaurants?

- A) 190
- B) 233
- C) 265
- D) 390

15

A circle is graphed in the  $xy$ -plane. If the circle has a radius of 3 and the center of the circle is at  $(4, -2)$ , which of the following could be an equation of the circle?

- A)  $(x + 4)^2 + (y - 2)^2 = 3$
- B)  $(x + 4)^2 - (y - 2)^2 = 3$
- C)  $(x - 4)^2 + (y + 2)^2 = 9$
- D)  $(x - 4)^2 - (y + 2)^2 = 9$

**Questions 16-18 refer to the following information.**

A high school developed a program called Propel, which offers extra guidance and support during the 9th-grade year. Before the school year began, 327 rising 9th graders were selected at random to participate in a study; 109 of those students were randomly assigned to enroll in the Propel program and the remaining students served as a control group. A summary of the year-end grade point averages (GPA) for the 327 9th-grade students who were chosen for the study is shown in the table below.

GPA for the 327 9th-Grade Students

| GPA            | Enrolled in Propel | Not enrolled in Propel |
|----------------|--------------------|------------------------|
| 3.0 or greater | 61                 | 95                     |
| Less than 3.0  | 48                 | 123                    |

16

If a 9th-grade student at the high school is chosen at random, which of the following is closest to the probability that the student will have a GPA of 3.0 or greater?

- A) 0.64
- B) 0.48
- C) 0.33
- D) 0.19

17

What is the difference, to the nearest whole percent, between the percentage of students enrolled in Propel who had a GPA of 3.0 or greater and the percentage of students not enrolled in Propel who had a GPA of 3.0 or greater?

- A) 4%
- B) 8%
- C) 10%
- D) 12%

18

Of the students enrolled in the Propel program, the ratio of boys to girls is approximately 2:3. Which of the following is the best estimate of the number of girls enrolled in the program?

- A) 44
- B) 65
- C) 73
- D) 131



19

An artist is creating a sculpture using bendable metal rods of equal length. One rod is formed into the shape of a square and another rod into the shape of an equilateral triangle. If each side of the triangle is 2 inches longer than each side of the square, how long, in inches, is each rod?

- A) 16
- B) 18
- C) 24
- D) 30

20

$$f(x) = \frac{2x - 4}{2x^2 + 2x - 4}$$

A rational function is defined above. Which of the following is an equivalent form that displays values not included in the domain as constants or coefficients?

- A)  $f(x) = \frac{x - 2}{x^2 + x - 2}$
- B)  $f(x) = \frac{2(x - 2)}{2(x + 2)(x - 1)}$
- C)  $f(x) = \frac{1}{x + 1}$
- D)  $f(x) = \frac{1}{2x^2}$

21

A landscaper is designing a rectangular fountain with a 4-foot-wide path around it. The equation  $A = 4p + 64$  will relate the area  $A$ , in square feet, of the path to the perimeter  $p$ , in feet, of the fountain. In the design, how many feet will the perimeter of the fountain increase for each additional square foot of the path's area?

- A)  $\frac{1}{64}$
- B)  $\frac{1}{4}$
- C) 4
- D) 64



22

In the  $xy$ -plane the graph of the function  $q$  is a parabola. The graph intersects the  $x$ -axis at  $(-1, 0)$  and  $(r, 0)$ . If the vertex of  $q$  occurs at the point  $(2, 4)$ , what is the value of  $r$ ?

- A) 0
- B) 3
- C) 4
- D) 5

23

Liquid going through a cooling system is chilled so that its temperature decreases at a constant rate from  $100^{\circ}\text{C}$  to  $25^{\circ}\text{C}$  in 5 seconds. Which of the following functions represents the temperature  $C$ , in degrees Celsius, as a function of the time  $t$ , in seconds, after chilling began, for  $0 \leq t \leq 5$ ?

- A)  $C = -25 + 15t$
- B)  $C = 25 - 15t$
- C)  $C = 25 + 15t$
- D)  $C = 100 - 15t$

24

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

The formula for the volume of a sphere with radius  $r$  is shown above. The radius of the planet Jupiter is about 11 times the radius of planet Earth. Assuming that planets are spheres, about how many times larger is the volume of Jupiter than the volume of Earth?

- A) 11
- B) 121
- C) 1,331
- D) 1,775



25

The population of squirrels in a park has been doubling every 15 years. Which of the following statements describes the type of function that best models the relationship between the population of squirrels in the park and the number of 15-year time periods?

- A) Exponential growth, because the population of squirrels is increasing by the same amount each 15-year time period
- B) Exponential growth, because the population of squirrels is increasing by the same percentage each 15-year time period
- C) Linear growth, because the population of squirrels is increasing by the same amount each 15-year time period
- D) Linear growth, because the population of squirrels is increasing by the same percentage each 15-year time period

26

If function  $f$  is defined by  $f(x) = 3x^2 - 5x + 4$ , what is  $f(x - 4)$ ?

- A)  $f(x - 4) = 3x^2 - 5x$
- B)  $f(x - 4) = 3x^2 - 5x + 72$
- C)  $f(x - 4) = 3x^2 - 29x + 52$
- D)  $f(x - 4) = 3x^2 - 29x + 72$

27

$$x = \frac{1}{3}y$$
$$154 - 4y = 10x$$

The equations of two lines are shown above. If the lines are graphed in the  $xy$ -plane, which of the following ordered pairs represents the point at which the lines would intersect?

- A) (1, 3)
- B) (3, 9)
- C) (5, 15)
- D) (7, 21)

**DIRECTIONS**

For questions 28-31, 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 circles accurately. You will receive credit only if the circles are filled in correctly.
- Mark no more than one circle 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  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:  $\frac{7}{12}$

Grid in result.

|   |   |   |   |   |
|---|---|---|---|---|
|   | 7 | / | 1 | 2 |
| . | . | . | . | . |
|   | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 | 9 |

← Fraction line

Answer: 2.5

|   |   |   |   |
|---|---|---|---|
|   | 2 | . | 5 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 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 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |

|   |   |   |   |
|---|---|---|---|
| . | 6 | 6 | 6 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |

|   |   |   |   |
|---|---|---|---|
| . | 6 | 6 | 7 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 |

Answer: 201 – either position is correct

|   |   |   |   |
|---|---|---|---|
|   | 2 | 0 | 1 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |

|   |   |   |   |
|---|---|---|---|
|   | 2 | 0 | 1 |
| . | . | . | . |
|   | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 |

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



28

| Type of meal     | Fat (g) | Carbohydrates (g) |
|------------------|---------|-------------------|
| Stir-fry         | 4       | 40                |
| Szechuan chicken | 5       | 35                |

A grocer carries two types of frozen meals that have the fat and carbohydrate content shown in the table above. John wants to purchase a combination of the two types of meals with no more than 350 grams of fat and no more than 2975 grams of carbohydrates. If John purchases 10 Szechuan chicken meals, what is the greatest number of stir-fry meals he can purchase so that the combination will satisfy the requirements?

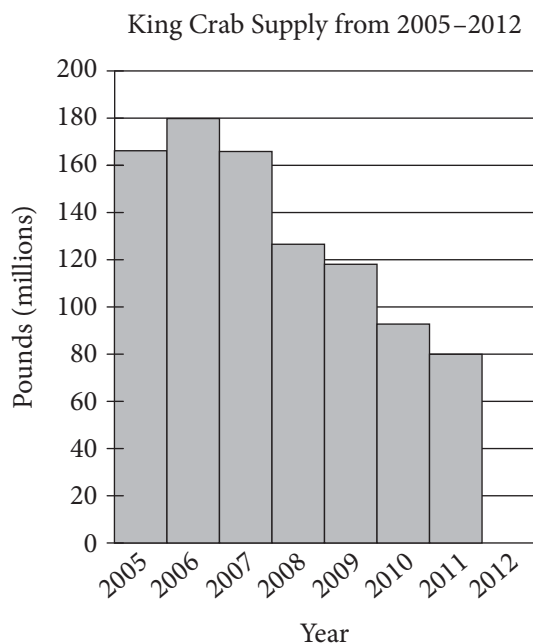
29

$$y = x^2 - 4x + 3$$
$$y = x - 1$$

If  $(x, y)$  is a solution to the system of equations above, what is one possible value of the product of  $x$  and  $y$ ?



Questions 30 and 31 refer to the following information.



The graph above shows the supply, in millions of pounds, of king crab harvested and sold from 2005 to 2011. The information for the year 2012 is not included in the graph.

30

In 2006, the price of king crab was \$8 per pound at the beginning of the year and dropped to \$7 per pound toward the end of the year. If 60% of the king crab supply was sold at the higher price per pound and the rest was sold at the lower price per pound, what was the total revenue generated, in millions of dollars, from the sales of king crab in 2006? (Disregard the \$ when gridding your answer.)

31

In 2011, the price of king crab was \$17 per pound. In 2012,  $x$  million pounds of king crab were sold at \$16 per pound. If the total money generated from sales each year was the same, what is the value of  $x$ ?

**STOP**

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