



# Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

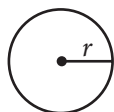
## DIRECTIONS

For questions 1-15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. For questions 16-20, 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

- The use of a calculator **is not permitted**.
- All variables and expressions used represent real numbers unless otherwise indicated.
- Figures provided in this test are drawn to scale unless otherwise indicated.
- All figures lie in a plane unless otherwise indicated.
- 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

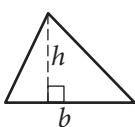


$$A = \pi r^2$$

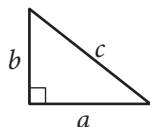
$$C = 2\pi r$$



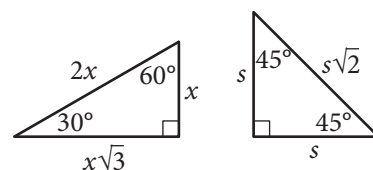
$$A = \ell w$$



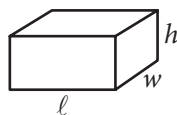
$$A = \frac{1}{2}bh$$



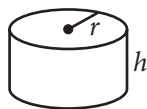
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = \ell wh$$



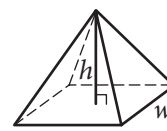
$$V = \pi r^2 h$$



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



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



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

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

Which of the following expressions is equal to 0 for some value of  $x$  ?

- A)  $|x - 1| - 1$
- B)  $|x + 1| + 1$
- C)  $|1 - x| + 1$
- D)  $|x - 1| + 1$

2

$$f(x) = \frac{3}{2}x + b$$

In the function above,  $b$  is a constant. If  $f(6) = 7$ , what is the value of  $f(-2)$  ?

- A)  $-5$
- B)  $-2$
- C)  $1$
- D)  $7$

3

$$\frac{x}{y} = 6$$

$$4(y + 1) = x$$

If  $(x, y)$  is the solution to the system of equations above, what is the value of  $y$  ?

- A) 2
- B) 4
- C) 12
- D) 24

4

If  $f(x) = -2x + 5$ , what is  $f(-3x)$  equal to?

- A)  $-6x - 5$
- B)  $6x + 5$
- C)  $6x - 5$
- D)  $6x^2 - 15x$



5

$$3(2x + 1)(4x + 1)$$

Which of the following is equivalent to the expression above?

- A)  $45x$
- B)  $24x^2 + 3$
- C)  $24x^2 + 18x + 3$
- D)  $18x^2 + 6$

6

If  $\frac{a-b}{b} = \frac{3}{7}$ , which of the following must also be true?

- A)  $\frac{a}{b} = -\frac{4}{7}$
- B)  $\frac{a}{b} = \frac{10}{7}$
- C)  $\frac{a+b}{b} = \frac{10}{7}$
- D)  $\frac{a-2b}{b} = -\frac{11}{7}$

7

While preparing to run a marathon, Amelia created a training schedule in which the distance of her longest run every week increased by a constant amount. If Amelia's training schedule requires that her longest run in week 4 is a distance of 8 miles and her longest run in week 16 is a distance of 26 miles, which of the following best describes how the distance Amelia runs changes between week 4 and week 16 of her training schedule?

- A) Amelia increases the distance of her longest run by 0.5 miles each week.
- B) Amelia increases the distance of her longest run by 2 miles each week.
- C) Amelia increases the distance of her longest run by 2 miles every 3 weeks.
- D) Amelia increases the distance of her longest run by 1.5 miles each week.



8

Which of the following equations represents a line that is parallel to the line with equation  $y = -3x + 4$  ?

- A)  $6x + 2y = 15$
- B)  $3x - y = 7$
- C)  $2x - 3y = 6$
- D)  $x + 3y = 1$

9

$$\sqrt{x-a} = x - 4$$

If  $a = 2$ , what is the solution set of the equation above?

- A)  $\{3, 6\}$
- B)  $\{2\}$
- C)  $\{3\}$
- D)  $\{6\}$

10

If  $\frac{t+5}{t-5} = 10$ , what is the value of  $t$  ?

- A)  $\frac{45}{11}$
- B) 5
- C)  $\frac{11}{2}$
- D)  $\frac{55}{9}$

11

$$x = 2y + 5$$

$$y = (2x - 3)(x + 9)$$

How many ordered pairs  $(x, y)$  satisfy the system of equations shown above?

- A) 0
- B) 1
- C) 2
- D) Infinitely many

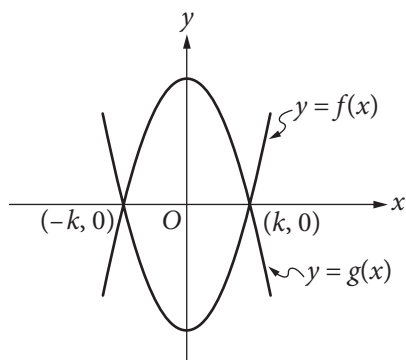


12

Ken and Paul each ordered a sandwich at a restaurant. The price of Ken's sandwich was  $x$  dollars, and the price of Paul's sandwich was \$1 more than the price of Ken's sandwich. If Ken and Paul split the cost of the sandwiches evenly and each paid a 20% tip, which of the following expressions represents the amount, in dollars, each of them paid? (Assume there is no sales tax.)

- A)  $0.2x + 0.2$
- B)  $0.5x + 0.1$
- C)  $1.2x + 0.6$
- D)  $2.4x + 1.2$

13



The functions  $f$  and  $g$ , defined by  $f(x) = 8x^2 - 2$  and  $g(x) = -8x^2 + 2$ , are graphed in the  $xy$ -plane above. The graphs of  $f$  and  $g$  intersect at the points  $(k, 0)$  and  $(-k, 0)$ . What is the value of  $k$ ?

- A)  $\frac{1}{4}$
- B)  $\frac{1}{2}$
- C) 1
- D) 2

14

$$\frac{8 - i}{3 - 2i}$$

If the expression above is rewritten in the form  $a + bi$ , where  $a$  and  $b$  are real numbers, what is the value of  $a$ ? (Note:  $i = \sqrt{-1}$ )

- A) 2
- B)  $\frac{8}{3}$
- C) 3
- D)  $\frac{11}{3}$

15

$$x^2 - \frac{k}{2}x = 2p$$

In the quadratic equation above,  $k$  and  $p$  are constants. What are the solutions for  $x$ ?

- A)  $x = \frac{k}{4} \pm \frac{\sqrt{k^2 + 2p}}{4}$
- B)  $x = \frac{k}{4} \pm \frac{\sqrt{k^2 + 32p}}{4}$
- C)  $x = \frac{k}{2} \pm \frac{\sqrt{k^2 + 2p}}{2}$
- D)  $x = \frac{k}{2} \pm \frac{\sqrt{k^2 + 32p}}{4}$



**DIRECTIONS**

For questions 16–20, 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 

3	1	/	2
•	•	•	•

 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.

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

	7	/	1	2
•	•	•	•	•
	0	0	0	0
1	1	•	1	1
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
8	8	8	8	8
9	9	9	9	9

Write answer in boxes. →

← Fraction line

Grid in result.

Answer: 2.5

	2	.	5
•	•	•	•
	0	0	0
1	1	1	1
2	•	2	2
3	3	3	3
4	4	4	4
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
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

.	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	•	•	•
7	7	7	7
8	8	8	8
9	9	9	9

.	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	•	•	•
7	7	7	•
8	8	8	8
9	9	9	9

Answer: 201 – either position is correct

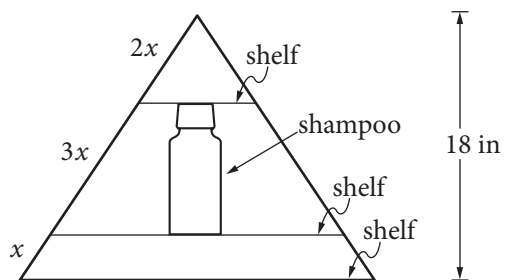
	2	0	1
•	•	•	•
	0	•	0
1	1	1	•
2	•	2	2
3	3	3	3

	2	0	1
•	•	•	•
	•	0	0
1	1	•	1
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.

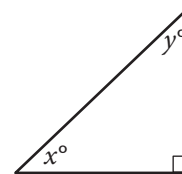


16



Jim has a triangular shelf system that attaches to his showerhead. The total height of the system is 18 inches, and there are three parallel shelves as shown above. What is the maximum height, in inches, of a shampoo bottle that can stand upright on the middle shelf?

17



In the triangle above, the sine of  $x^\circ$  is 0.6. What is the cosine of  $y^\circ$ ?

18

$$x^3 - 5x^2 + 2x - 10 = 0$$

For what real value of  $x$  is the equation above true?



19

$$-3x + 4y = 20$$

$$6x + 3y = 15$$

If  $(x, y)$  is the solution to the system of equations above, what is the value of  $x$  ?

20

The mesosphere is the layer of Earth's atmosphere between 50 kilometers and 85 kilometers above Earth's surface. At a distance of 50 kilometers from Earth's surface, the temperature in the mesosphere is  $-5^\circ$  Celsius, and at a distance of 80 kilometers from Earth's surface, the temperature in the mesosphere is  $-80^\circ$  Celsius. For every additional 10 kilometers from Earth's surface, the temperature in the mesosphere decreases by  $k^\circ$  Celsius, where  $k$  is a constant. What is the value of  $k$  ?

**STOP**

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