



# Math Test – No Calculator

25 MINUTES, 17 QUESTIONS

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

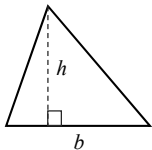
## DIRECTIONS

Questions **1-13** ask you to solve a problem, select the best answer among four choices, and fill in the corresponding circle on your answer sheet. Questions **14-17** ask you to solve a problem and enter your answer in a grid provided on your answer sheet. There are detailed instructions on entering answers into the grid before question 14. You may use your test booklet for scratch work.

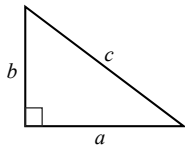
## NOTES

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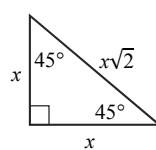
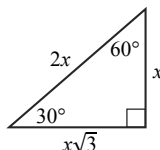
## REFERENCE



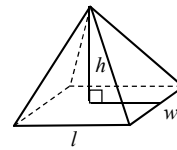
$$A = \frac{1}{2}bh$$



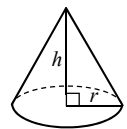
$$a^2 + b^2 = c^2$$



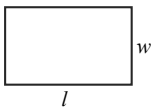
Special Triangles



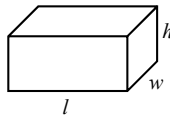
$$V = \frac{1}{3}lwh$$



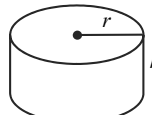
$$V = \frac{1}{3}\pi r^2h$$



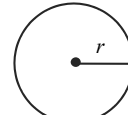
$$A = lw$$



$$V = lwh$$

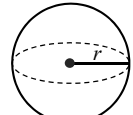


$$V = \pi r^2h$$



$$A = \pi r^2$$

$$C = 2\pi r$$



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

There are  $360^\circ$  in a circle.

The sum of the angles in a triangle is  $180^\circ$ .

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

CONTINUE



1

Madison leaves her house and bikes north at a constant speed of 10 miles per hour. If her dad leaves the same house two hours later, driving north at a constant speed of 15 miles per hour, how long will it take him, in hours, to reach Madison?

- A) 2
- B) 3
- C) 4
- D) 5

2

If  $(x - 1)(x + 4) = 0$ , what are the values for  $x$ ?

- I. 4
  - II. 1
  - III. -1
  - IV. -4
- A) I and III
  - B) II and IV
  - C) III and IV
  - D) I and II

3

Bats detect the locations of objects by bouncing sound waves off of objects, in a process known as echolocation. The speed of a sound wave is approximately 350 meters per second. A bat emits a sound wave towards a tree 525 meters away. What is the time, in seconds, that it takes for the sound wave to reach the tree?

- A) 0.5
- B) 1
- C) 1.5
- D) 2

4

$$w = \frac{l}{8}$$

$$h = 3w$$

An engineer determined that a bridge he is designing has maximum stability when its length,  $l$ , width,  $w$ , and height,  $h$ , are defined by the equations above. If he wants to build a bridge with a height of 9 meters, what should be the length of the bridge, in meters?

- A) 48
- B) 24
- C) 12
- D) 6



5

If the sum of two consecutive integers is 15, what is their product?

- A) 36
- B) 48
- C) 56
- D) 64

6

$x$	$f(x)$
-3	8
-2	3
-1	0
0	-1
1	0

Which of the following equations describes the chart above?

- A)  $f(x) = x - x^2$
- B)  $f(x) = x - 1$
- C)  $f(x) = x^2 - 1$
- D)  $f(x) = x^2$

7

In DNA sequencing, a machine is able to identify the sequence of units of DNA, called base pairs. It costs approximately 10 cents to sequence 1000 base pairs. If an investigator would like to sequence a gene consisting of 120,000 base pairs from each of 100 samples, how much would it cost for him to obtain the sequences?

- A) \$120
- B) \$480
- C) \$720
- D) \$1200

8

$$2x^2 - x = 15$$

Which of the following is a correct value for  $x$  in the equation above?

- A) 3
- B) 2
- C) -2
- D) -4



9

The velocity of a ball that is thrown upwards is represented by the equation  $v = -5t^2 - 20t + 60$ , where  $v$  represents velocity and  $t$  represents time, in seconds. After how many seconds does the velocity of the ball become zero?

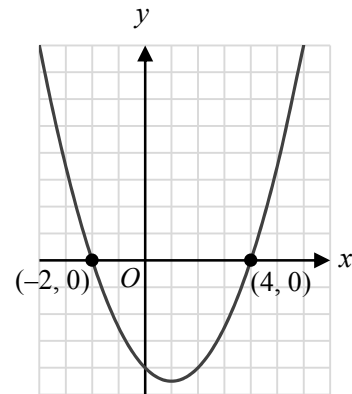
- A) 2
- B) 3
- C) 6
- D) 12

10

If  $x = 4y + 3$  and  $y = -2x - 3$ , what is the value of  $xy$ ?

- A) -1
- B) 0
- C) 1
- D) 3

11



The graph above could be a representation of which of the following equations?

- A)  $y = x - 1$
- B)  $y = x^2 - 2x - 9$
- C)  $y = (x - 1)^2 - 9$
- D)  $y = x^2$



12

If  $3^{2x+2} = 27^2$ , what is the value for  $x$ ?

- A) 0
- B) 1
- C) 2
- D) 3

13

If  $\sqrt{12 \times \sqrt{k}} = 6a$ , what is the value of  $k$  in terms of  $a$ ?

- A)  $3a$
- B)  $3a^2$
- C)  $9a^2$
- D)  $9a^4$

A grey arrow pointing to the right with the word "CONTINUE" written inside it in a bold, sans-serif font.

CONTINUE


**DIRECTIONS**

Questions **14-17** ask you to solve a problem and enter your answer in the grid provided on your answer sheet. When completing grid-in questions:

- You are required to bubble in the circles for your answers. It is recommended, but not required, that you also write your answer in the boxes above the columns of circles. Points will be awarded based only on whether the circles are filled in correctly.
- Fill in only one circle in a column.
- You can start your answer in any column as long as you can fit in the whole answer.
- For questions 14-17, no answers will be negative numbers.
- Mixed Numbers**, such as  $4\frac{2}{5}$ , must be gridded as decimals or improper fractions, such as 4.4 or as  $\frac{22}{5}$ . "42/5" will be read as "forty-two over five," not as "four and two-fifths."
- If your answer is a **decimal** with more digits than will fit on the grid, you may round it or cut it off, but you must fill the entire grid.
- If there are **multiple correct solutions** to a problem, all of them will be considered correct. Enter only **one** on the grid.

5	/	1	1
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2	2	2	2
3	3	3	3
4	4	4	4
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6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

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9	9	9	9

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7	7	7	7

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7	7	7	7

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



14

If the sum of the even integers between 1 and  $k$ , inclusive, is equal to  $2k$ , what is the value of  $k$ ?

15

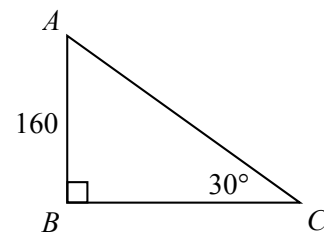
If  $a$  is a non-zero digit in the numbers  $1a2a$  and  $a31$ , what is the value of  $a$  when  $1a2a + a31 = 2659$ ?

16

$f(x) = x^2 + d$  and  $g(x) = 2x^2$ , where  $d$  is a constant.

If  $\frac{f(g(2))}{f(2)} = 4$ , what is the value of  $d$ ?

17



What is the length of  $\overline{AC}$  in the diagram above?

# STOP

If you complete this section before the end of your allotted time, check your work on this section only. Do NOT use the time to work on another section.



# Math Test – Calculator

45 MINUTES, 31 QUESTIONS

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

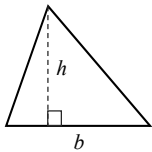
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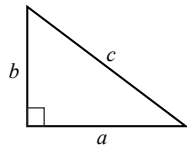
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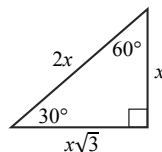
## REFERENCE



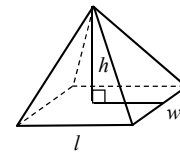
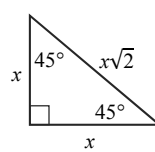
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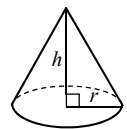
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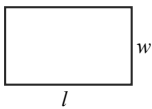
Special Triangles



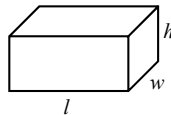
$$V = \frac{1}{3}lwh$$



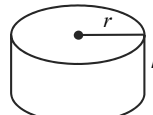
$$V = \frac{1}{3}\pi r^2 h$$



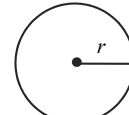
$$A = lw$$



$$V = lwh$$

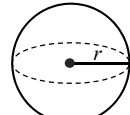


$$V = \pi r^2 h$$



$$A = \pi r^2$$

$$C = 2\pi r$$



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

There are  $360^\circ$  in a circle.

The sum of the angles in a triangle is  $180^\circ$ .

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

CONTINUE





1

Which of the following expressions is equivalent to  $(3x - 2)(x + 1)$ ?

- A)  $3x^2 - 2$
- B)  $4x - 2$
- C)  $3x^2 - x - 2$
- D)  $3x^2 + x - 2$

2

An athlete throws a javelin, a long metal spear, at a track and field competition. The javelin's height in feet,  $h$ , as a function of the number of seconds since it was thrown,  $t$ , is modelled by the equation  $h(t) = -16t^2 + 128t$ . What is the height of the javelin after 5 seconds?

- A) 0 feet
- B) 8 feet
- C) 240 feet
- D) 480 feet

3

$$\boxed{x} - \boxed{y} = 2x - 3y$$

If  $x$  and  $y$  are integers in the diagram above, what is the value of  $\boxed{-3} - \boxed{4}$ ?

- A)  $-18$
- B)  $-6$
- C)  $6$
- D)  $18$

4

Depreciation is the decrease in value of an item. Three years ago, Aaron bought a computer for \$930. The computer is now worth \$570. Assuming that the value of the computer depreciates linearly, what is its yearly depreciation?

- A) \$120
- B) \$180
- C) \$200
- D) \$240



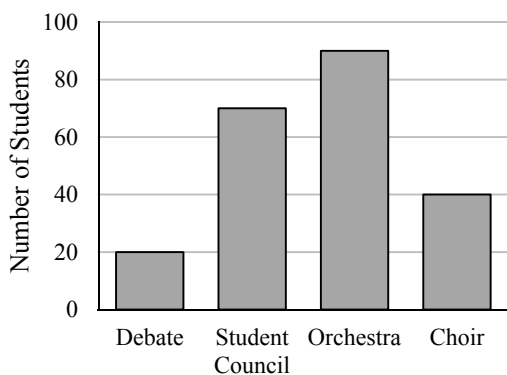
5

On a house blueprint, 2 feet is represented by 1 inch. If a room on the blueprint measures 5 inches by 6 inches, what is the area of the actual room?

- A) 30 square feet
- B) 60 square feet
- C) 90 square feet
- D) 120 square feet

6

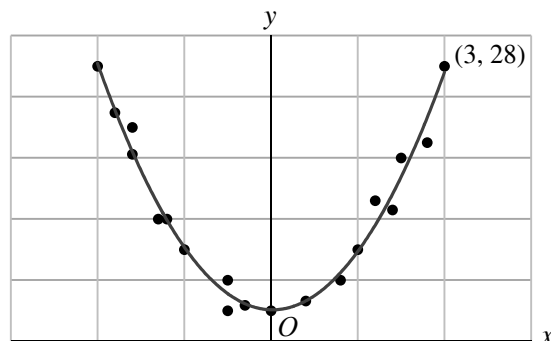
Club Participation at a School



The graph above shows the student participation for 4 school clubs. Each student is allowed to participate in only one club. If the school has 250 students, how many students are not in a club?

- A) 220
- B) 90
- C) 60
- D) 30

7



Which of the following equations best describes the trend line for the scatterplot above?

- A)  $y = 3x^2 + 1$
- B)  $y = x^2 + 2$
- C)  $y = 3x + 1$
- D)  $y = 3x$

8

Costs Comparison of Tools

Item	Cost at John's Tools	Cost at Lin's Tools
Hammer	\$15	\$18
Drill	\$50	\$55
Electric saw	\$30	\$25

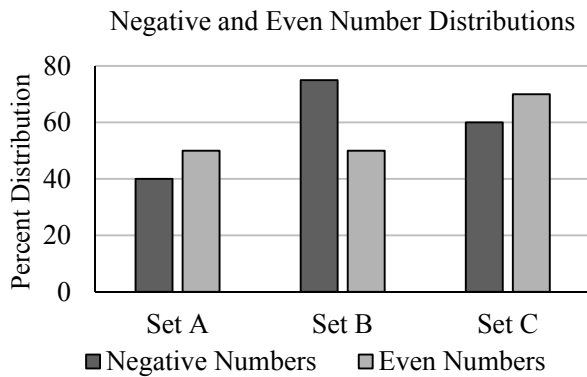
If a distributor receives a 10% discount from John's Tools and a 15% discount from Lin's Tools, how much more would they pay, in dollars, to buy a drill and electric saw from John's Tools than Lin's Tools?

- A) 4
- B) 5
- C) 6
- D) 7

CONTINUE



Questions 9 and 10 refer to the following information.



The graph above shows the distribution of negative and even numbers in three sets of numbers.

9

How many sets had more even than negative numbers?

- A) 0
- B) 1
- C) 2
- D) 3

10

If Set B has 200,000 elements, how many more negative numbers than even numbers would we expect to find in the set?

- A) 25,000
- B) 50,000
- C) 100,000
- D) 155,000

11

One byte is a unit of memory size used with computers. One megabyte contains approximately  $10^6$  bytes and Paul's computer hard-drive accesses information at a rate of 150 megabytes per second. If Paul wants to work with 5 files on his computer that are  $2,340 \times 10^6$  bytes each, approximately how long will it take his computer to access them?

- A) 15.6 seconds
- B) 39 seconds
- C) 1.3 minutes
- D) 78 minutes



12

	5 cent coins	10 cent coins	25 cent coins	Total coins
Offer 1	20	15	4	39
Offer 2	25	5	8	38
Total	45	20	12	77

Maria has been offered an exchange of coin collections for her wood carving. A summary of the coin collections is found in the table above. If she evaluates the offers based only on the face value of the coins, which collection is Maria most likely to choose?

- A) The coins are worth the same so Maria is equally likely to pick either one.
- B) Offer 1 is worth more than Offer 2, so Maria will pick Offer 1.
- C) Offer 2 is worth more than Offer 1, so Maria will pick Offer 2.
- D) Offer 1 has the greater number of coins, so Maria will pick Offer 1.

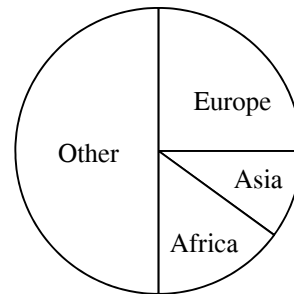
13

During the first month of life, a newborn's weight increases by 30%. If a newborn weighs  $w$  pounds when it is one month old, which of the following expressions represent the baby's weight at birth?

- A)  $(0.3)w$
- B)  $(1.3)w$
- C)  $\frac{w}{1.3}$
- D)  $\frac{1.3}{w}$

Questions 14 and 15 refer to the following information.

Immigration Demographics



The pie chart above shows the distribution of immigrants in a city, based on continent of origin.

14

25% of the immigrant population originated in which of the following continents?

- A) Asia and Europe
- B) Asia and Africa
- C) Africa and Europe
- D) Other

15

20% of the immigrant population from Europe are from France. If there are a total of 1500 immigrants in the city, how many immigrants are from France?

- A) 50 people
- B) 75 people
- C) 100 people
- D) 120 people

CONTINUE



16

If 10% of a number is 12, then what is the value of 5% of half of the original number?

- A) 2
- B) 3
- C) 4
- D) 5

17

$$\begin{aligned}a &= -2b - 3 \\ b - a &= -24\end{aligned}$$

What is the value of  $a + b$  in the system of equations above?

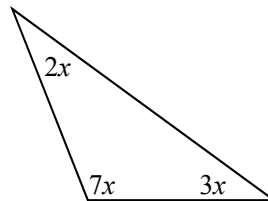
- A) -27
- B) -9
- C) 6
- D) 15

18

Which of the following is the sum of 3 consecutive odd integers?

- A) 23
- B) 26
- C) 105
- D) 290

19



What is the value of the largest angle in the triangle above?

- A) 120 degrees
- B) 115 degrees
- C) 110 degrees
- D) 105 degrees

20

The average in Set A is 85 and the average in Set B is 65. If the combined average of all the elements in Set A and Set B is 70, and Set A has 5 elements, how many elements are in Set B?

- A) 45
- B) 30
- C) 15
- D) 5



21

A species of shark spends 25% of a day,  $d$ , sleeping, and 50% of the remaining time hunting. Which of the following expressions represents how many hours in one day are left for other activities?

- A)  $\frac{3d}{2}$   
 B)  $\frac{3d}{4}$   
 C)  $\frac{3d}{8}$   
 D)  $\frac{3d}{12}$

22

Age	Male	Female	Total
0-18 years old	56	50	106
19-40 years old	108	90	198
41-65 years old	126	135	261
66+ years old	90	95	185
Total	380	370	750

The age of a random sample of people from a population is summarized in the table above. The whole population consists of 31,000 people. Which of the following statements is true?

- A) We expect that there are 15,200 females in the population.  
 B) We expect there to be 5580 females 65 years old and younger in the population.  
 C) We expect there to be 9300 females between 19 and 65 years old in the population.  
 D) We cannot determine the number of females in the population with the information given.

23

If  $2x^2 - 2y^2 = 72$  and  $x + y = 18$  what is the value of  $x - y$ ?

- A) 2  
 B) 4  
 C) 6  
 D) 8



24

If  $\sqrt{10x + 35} = x + 6$  what is/are the value(s) of  $x$  divided by two?

- A)  $-\frac{1}{2}$
- B)  $-\frac{7}{2}$
- C)  $-\frac{1}{2}$  and  $-\frac{7}{2}$
- D) 0 and  $-\frac{1}{2}$

25

Employees at a Hospital

Years Worked	Nurse	Doctor	Technician	Total
Less than 2	20	10	20	50
2 to 5	15	15	10	40
6 to 10	13	18	18	49
More than 10	12	10	12	34
Total	60	53	60	173

The table above shows the years worked by employees at a hospital. What is the probability that a technician has worked for 6 or more years?

- A) 90%
- B) 75%
- C) 65%
- D) 50%

26

$$f(x) = 2x^2 + a$$

If  $a$  is a constant and  $f(2) + f(3) = f(5)$ , what is the value of  $a$ ?

- A) 6
- B) 12
- C) 24
- D) 48

27

$$3x + 4y = 12$$

$$4x + 3y = -5$$

What is the value of  $x + y$ , in the system of equations shown above?

- A) 4
- B) 3
- C) 2
- D) 1


**DIRECTIONS**

Questions **28-31** ask you to solve a problem and enter your answer in the grid provided on your answer sheet. When completing grid-in questions:

- You are required to bubble in the circles for your answers. It is recommended, but not required, that you also write your answer in the boxes above the columns of circles. Points will be awarded based only on whether the circles are filled in correctly.
- Fill in only one circle in a column.
- You can start your answer in any column as long as you can fit in the whole answer.
- For questions 28-31, no answers will be negative numbers.
- Mixed Numbers**, such as  $4\frac{2}{5}$ , must be gridded as decimals or improper fractions, such as 4.4 or as  $\frac{22}{5}$ . "42/5" will be read as "forty-two over five," not as "four and two-fifths."
- If your answer is a **decimal** with more digits than will fit on the grid, you may round it or cut it off, but you must fill the entire grid.
- If there are **multiple correct solutions** to a problem, all of them will be considered correct. Enter only **one** on the grid.

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

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

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

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

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

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





28

If  $(x^2 + 5) = 7$  and  $(x^2 + 5)k = 21$ , what is the value of  $k$ ?

29

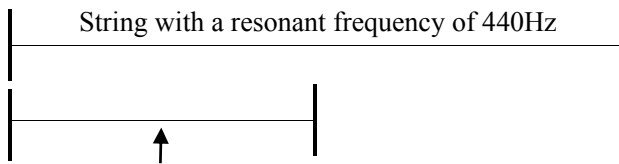
There are 42 integers in a group. If there are 5 times as many odd integers as there are even integers, how many numbers are even integers?

CONTINUE



Questions 30-31 refer to the following information.

One Hz is a measure of frequency and is equal to one cycle per second. The A string on a violin is tuned to a resonant frequency of 440Hz. If the string length is decreased, its resonant frequency, measured in Hz, is increased. The decrease in string length changes the string frequency according to the equation  $f = \frac{v}{2l}$ , where  $f$  is the frequency in Hz,  $v$  is a constant, and  $l$  is the string length. An application of this equation is demonstrated in the diagram below:



The same string is decreased by half, resulting in a resonant frequency of 880Hz

30

If the length of an A string on a violin is decreased by one quarter, what is the resonant frequency of the string, rounded to the nearest Hz?

31

The violin has another string, called the D string, which is tuned to resonate at 293.7Hz. If the lengths of a violin A and D string are decreased by half, what is the difference in resonant frequency between these two strings? (Round your answer to the nearest Hz.)

## STOP

**If you complete the problem set before time elapses, you may review your responses for this section. Do not view or begin working on any other sections.**

### SECTION 3

- |      |       |       |         |
|------|-------|-------|---------|
| 1. C | 6. C  | 11. C | 16. 16  |
| 2. B | 7. D  | 12. C | 17. 320 |
| 3. C | 8. A  | 13. D |         |
| 4. B | 9. A  | 14. 6 |         |
| 5. C | 10. C | 15. 8 |         |

### SECTION 4

- |      |       |       |         |
|------|-------|-------|---------|
| 1. D | 9. C  | 17. C | 25. D   |
| 2. C | 10. B | 18. C | 26. C   |
| 3. A | 11. C | 19. D | 27. D   |
| 4. A | 12. C | 20. C | 28. 3   |
| 5. D | 13. C | 21. C | 29. 7   |
| 6. D | 14. B | 22. C | 30. 587 |
| 7. A | 15. B | 23. A | 31. 293 |
| 8. A | 16. B | 24. A |         |