

CERT – Grade 11 – Mathematics – Test 1

60 Minutes—60 Questions

DIRECTIONS: Solve each problem, choose the correct answer, and then fill in the corresponding oval on your answer sheet.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left for this test.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose,

but some of the problems may be best done without using a calculator.

Note: Unless otherwise stated, all of the following should be assumed:

1. Illustrative figures are NOT necessarily drawn to scale.
2. Geometric figures lie in a plane.
3. The word *line* indicates a straight line.
4. The word average indicates arithmetic mean.

1. $|2 - 8| - |2 + 8| = ?$

- A. -16
- B. -4
- C. 0
- D. 4
- E. 16

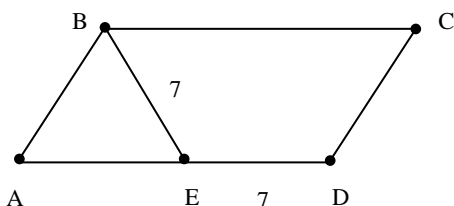
DO FIGURING HERE

2. Kevin drove 95 miles to meet his friend Amanda at an amusement park. Amanda drove 125 miles to get to the same amusement park. Given that Kevin's truck uses one gallon of gasoline every 15 miles and Amanda's hybrid car uses one gallon of gasoline every 40 miles, approximately how many more gallons of gasoline did Kevin's truck use than Amanda's car to reach the amusement park?

- F. 3
- G. 4
- H. 6
- J. 7
- K. 8

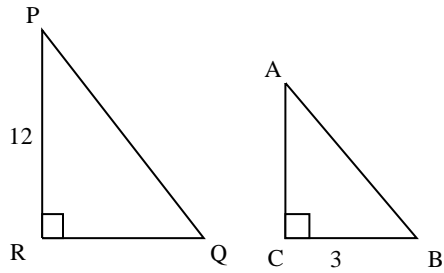
3. The figure below depicts parallelogram ABCD with equilateral triangle ABE. $\overline{BE} = \overline{DE} = 7$ as shown. What is the perimeter of the parallelogram?

- A. 21
- B. 28
- C. 35
- D. 42
- E. 49



GO ON TO NEXT PAGE

4. In the figure below, $\triangle PQR$ is similar to $\triangle ABC$. If the area of $\triangle ABC$ is 6, what is the area of $\triangle PQR$?

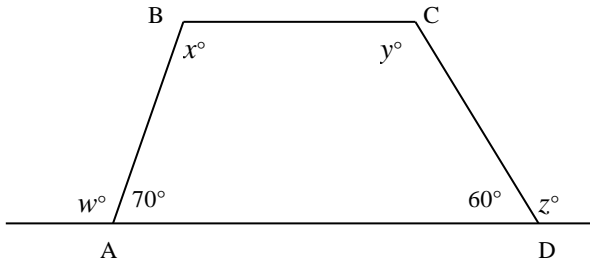


DO YOUR FIGURING HERE.

- F. 18
G. 36
H. 54
J. 96
K. 108
5. If 60% of a given number is 18.0, what is 25% of the given number?
- A. 2.7
B. 4.5
C. 7.5
D. 12.0
E. 13.5
6. A woman has three different hats, two different jackets, and six different blouses. If an outfit consists of one hat, one jacket, and one blouse, how many different outfits can the woman choose?
- F. 2
G. 3
H. 11
J. 36
K. 49
7. Which of the following is the slope of a line perpendicular to the line defined by $y - 2 = 3x$?
- A. -3
B. $-\frac{1}{3}$
C. $\frac{1}{3}$
D. 2
E. 3

GO ON TO THE NEXT PAGE.

8. Given quadrilateral ABCD, what is the sum of w , x , y , and z ?



DO YOUR FIGURING HERE.

- F. 230
G. 280
H. 360
J. 420
K. 460
9. If Set A consists of all prime numbers and Set B consists of all multiples of 3, which of the following represents the intersection of Set A and Set B?
- A. {3}
B. {1, 3}
C. {1, 3, 6, 9, 12, 15, ...}
D. {1, 3, 9, 15, 21, 27, ...}
E. {1, 2, 3, 4, 5, 6, 7, ...}
10. What is the largest integer less than $\sqrt{15}$?
- F. 6
G. 5
H. 4
J. 3
K. 2

GO ON TO THE NEXT PAGE.

Use the following information to answer questions 11 through 13.

DO YOUR FIGURING HERE.

Of the 500 students who attend West Middle School, 95 are boys who play a musical instrument and 75 are girls who play a musical instrument.

- 11.** What percent of the students who attend West Middle School play a musical instrument?
- A.** 15 %
 - B.** 17 %
 - C.** 19 %
 - D.** 26 %
 - E.** 34 %
- 12.** If 60 % of the boys and 40% of the girls who play a musical instrument play a brass instrument, how many of the students who attend West Middle School do NOT play a brass instrument?
- F.** 77
 - G.** 83
 - H.** 87
 - J.** 413
 - K.** 417
- 13.** Girls who attend West Middle School and play a musical instrument constitute a certain percent of the total school population. If this percent were represented as a wedge in a circle graph, what would the central angle of the wedge be?
- A.** 15°
 - B.** 19°
 - C.** 54°
 - D.** 68°
 - E.** 75°

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

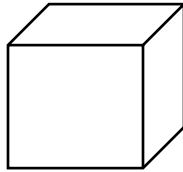
14. If the side of one square is 3 times the side of a second square, what is the ratio of the area of the smaller square to the area of the larger square?
- F. 1:3
 - G. 3:1
 - H. 9:1
 - J. 1:9
 - K. 1:6

15. $3w + 2 < -12 - (3w - 2)$ is equivalent to:

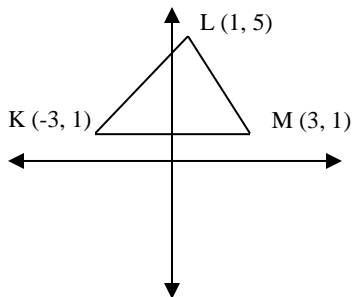
- A. $w > -3$
- B. $w > -2$
- C. $w < -2$
- D. $w > 2$
- E. $w < 3$

16. If the volume of the cube below is 27 units cubed, what is the total surface area of the cube in units squared?

- F. 36
- G. 54
- H. 69
- J. 81
- K. 162



17. In the figure below, $\triangle KLM$ in the standard coordinate plane has vertices as indicated. What is the area of $\triangle KLM$?



- A. 30
- B. 24
- C. 18
- D. 15
- E. 12

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

18. The value, V , of a particular car (in dollars) t years after it is sold by a dealership can be calculated using the formula $V(t) = 20,000 - 3,000(d)^t$. If V is \$17,570 two years after the car is sold by a dealership, what is the value of d ?

- F. -2.2
- G. 0.9
- H. 1.4
- J. 2.3
- K. 2.7

19. What is the product of the complex number $2 + 7i$ and the complex number $3 - 2i$?

- A. $5 + 5i$
- B. $6 - 14i$
- C. 20
- D. $20 + 17i$
- E. $-8 + 17i$

20. Given that $V = \pi r^2 h$, what happens to the value of V , when the value of r is doubled and the value of h is divided by 2?

- F. V is divided by 2
- G. V remains unchanged
- H. V is doubled
- J. V is tripled
- K. It cannot be determined from the given information

21. $(x - 2)^2 = ?$

- A. $x^2 - 4$
- B. $x^2 + 4$
- C. $x^2 - 4x + 4$
- D. $x^2 + 4x + 4$
- E. $x^2 - 4x - 4$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

22. Which of the following is equal to $\log \frac{B^A}{D^C}$?

- F. $AC \log (B - D)$
- G. $A \log B - C \log D$
- H. $B \log A + D \log C$
- J. $B \log A - D \log C$
- K. $A \log B \div C \log D$

23. Which of the following is not a rational number?

- A. $\sqrt{7}$
- B. $\sqrt{7.29}$
- C. $\sqrt{196}$
- D. $\sqrt{\frac{4}{9}}$
- E. $4\frac{1}{5}$

24. An alarm inside a laboratory sounds randomly for 5 seconds during every 5 minute interval starting at noon every day. If a student enters the laboratory at 12:36 one afternoon, what is the probability that the alarm will be sounding at the time the student enters the laboratory?

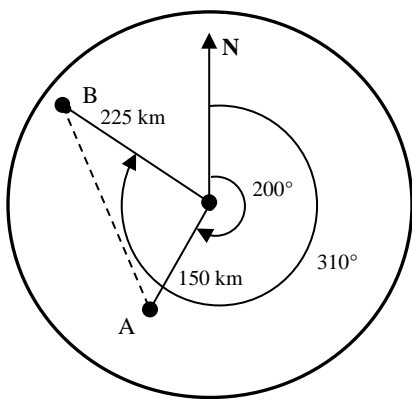
- F. $\frac{1}{300}$
- G. $\frac{1}{60}$
- H. $\frac{1}{59}$
- J. $\frac{5}{59}$
- K. $\frac{1}{5}$

GO ON TO THE NEXT PAGE.

25. How many non-overlapping circles with area 81π can fit within a 37 by 55 rectangle?

- A. 6
- B. 7
- C. 8
- D. 9
- E. 10

26. The figure below shows two boats on a circular radar screen. Boat A is 150 km from the center with a bearing of 200° . Boat B is 225 km from the center with a bearing of 310° . What is the approximate distance between the two boats?



- F. 200 km
- G. 240 km
- H. 310 km
- J. 400 km
- K. 440 km

27. A woman standing 6 feet west of the southwest corner of her house is watching a bird 11 feet up in a tree that is 8 feet south of the southwest corner of the house. When observing the bird using binoculars, she holds the binoculars 5 feet off the ground. What is the approximate distance from the bird to the binoculars?

- A. 10 feet
- B. 12 feet
- C. 14 feet
- D. 15 feet
- E. 17 feet

DO YOUR FIGURING HERE.

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

28. Which of the following is the equation of the perpendicular bisector of the segment with endpoints $(2, 4)$ and $(4, -2)$ in the xy -coordinate plane?

F. $y = \frac{1}{3}x$

G. $y = \frac{1}{3}x + 1$

H. $y = -3x$

J. $y = -\frac{1}{3}x - 1$

K. $y = 3x$

29. What is the next number in the following sequence of numbers:

$\frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{8}{9}, \dots$

A. $\frac{9}{10}$

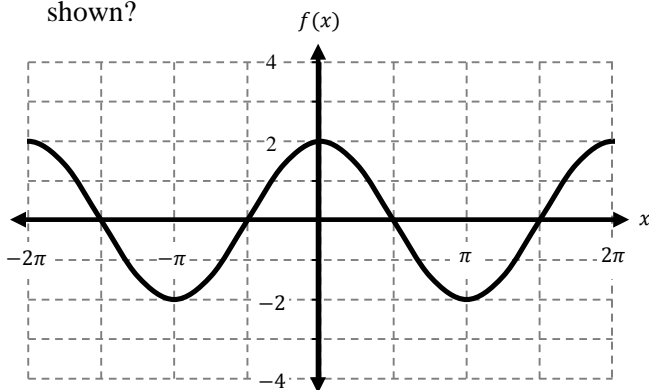
B. $\frac{10}{11}$

C. $\frac{11}{12}$

D. $\frac{12}{13}$

E. $\frac{13}{11}$

30. Which function can be used to create the graph shown?



F. $f(x) = 2 \sin(x)$

G. $f(x) = 2 \cos(x)$

H. $f(x) = \sin(2x)$

J. $f(x) = \cos(2x)$

K. $f(x) = 2 \tan(2x)$

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

31. Diana plans to sell hand-knit scarves for \$25.00 each at a craft fair. If the cost of renting a vendor table at the fair is \$50.00, how many scarves will Diana need to sell at the fair in order to make \$450.00?

- A. 16
- B. 18
- C. 19
- D. 20
- E. 22

32. $45m^2 - 28 - 23m + 3m^2 + 3m - 41$ is equivalent to:

- F. $-41m^4$
- G. $45m^2 - 23m - 69$
- H. $48m^2 - 20m - 69$
- J. $48m^4 - 20m^2 - 69$
- K. $49m^2 - 26m - 69$

33. Which of the following values of x are solutions of $x^2 - 5x = 24$?

- A. -8 and 3
- B. -5 and 8
- C. -3 and -2
- D. -3 and 8
- E. 5 and 8

34. The following integers represent Katrina's scores on 6 math tests. If the total of her scores is 532, what is the value of m ?

$m - 1$	$m + 4$	$m - 6$
$m + 3$	$m + 7$	$m - 3$

- F. 88
- G. 89
- H. 90
- J. 91
- K. 92

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

35. What is the y -intercept of a line in the standard (x, y) coordinate plane that has points $(-2, -4)$ and $(-6, 2)$?
- A. -7
 - B. -4
 - C. -2
 - D. 0
 - E. 4

36. A candy manufacturer has chocolate, sugar, and butter delivered to two different manufacturing sites (Site M and Site N). The matrices below show how many cases of each product were delivered in a given time period, as well as how much each case weighed. During the time period, how many more pounds of chocolate were delivered than pounds of sugar and butter combined?

	Chocolate	Sugar	Butter
Site M	10	4	4
Site N	14	6	8

	Pounds per Case
Chocolate	20
Sugar	30
Butter	12

- F. 36
 - G. 60
 - H. 164
 - J. 158
 - K. 180
37. After dividing a bag of candy among three friends, the friends find that ratio of pieces of candy is 3:2:2. If the friend with the most candy had 9 pieces, how many did the others have together?
- A. 4
 - B. 6
 - C. 12
 - D. 14
 - E. 21

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

38. Craig sells lemonade from a stand. The profit, P , that he makes by selling c cups of lemonade is represented by the function $P(c) = 0.50c - 4.00$. How many cups of lemonade does Craig need to sell to make a profit of \$5.00 ?

- F. 9
- G. 10
- H. 12
- J. 16
- K. 18

39. If $b > 1$, then $\frac{4b^5}{2b^3 \cdot b^4}$ equals:

- A. $-2b^7$
- B. $\frac{1}{2b^7}$
- C. $\frac{1}{2b^2}$
- D. $\frac{2}{b^2}$
- E. $2b^2$

40. Supria and Elle live 21 miles apart. They leave their respective homes at the same time to go for a jog. They begin running toward each other with the intent of meeting. Supria runs at a constant rate of 6 miles per hour and Elle runs at constant rate of 8 miles per hour. A third friend starts at Supria's house and rides her bike toward Elle's house at a constant rate of 10 miles per hour. How far will the bicyclist have ridden when Supria and Elle finally meet?

- F. 6 miles
- G. 10 miles
- H. 12 miles
- J. 14 miles
- K. 15 miles

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

41. Express Coffee Shop is open 12 hours a day with 2 employees working at a time earning \$10.00 an hour each. A small cup of coffee costs the shop \$0.30 to produce and a large cup of coffee costs the shop \$0.90 to produce. Which of the following represents the owner's daily costs to run the coffee shop when s small coffees and l large coffees are sold?

- A. $(s + l)(\$2.70) + \120
- B. $(\$0.30s + \$0.90l) - \$240$
- C. $\$0.30s + \$0.90l + \$240$
- D. $\$120 + \$0.30s + \$0.90l$
- E. $\$240 - (\$0.30s + \$0.90l)$

42. Miley walks to school by 1 of 3 routes in the morning. After school she chooses from 4 different routes to get to work. When work is done she travels home by 1 of 5 different ways. How many different routes can Miley travel from home to school to work and back home again?

- F. 12
- G. 24
- H. 60
- J. 120
- K. 144

43. The formula to compute the current value of an investment is $A = P(1 + r)^n$, where A is the value of the investment; P is the amount invested; r is the annual rate of return expressed as a decimal; and n is the number of years the amount is invested. If a woman invests \$5,000 and the annual rate of return is 8 %, what is the value of the investment after 15 years?

- A. \$2,000
- B. \$5,400
- C. \$10,882
- D. \$15,861
- E. \$21,499

GO ON TO THE NEXT PAGE.

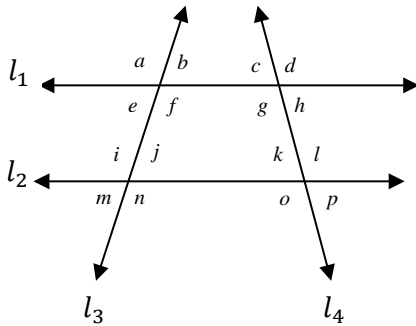
DO YOUR FIGURING HERE.

44. If $f(x) = x + 4$ and $g(x) = x^2 + 2x$, what is $f(g(-1))$?
- F. 3
G. 5
H. 7
J. 11
K. 15

45. $3x^2(2x^2)^3$ is equivalent to:

- A. $18x^8$
B. $24x^8$
C. $24x^{10}$
D. $24x^{16}$
E. $72x^8$

46. Given lines 1, 2, 3, and 4 in the figure below, with $l_1 \parallel l_2$, which of the following must be true?



- F. $m\angle a + m\angle e = m\angle k + m\angle p$
G. $m\angle c + m\angle h = m\angle l + m\angle o$
H. $m\angle e + m\angle i = m\angle g + m\angle l$
J. $m\angle f + m\angle j = m\angle d + m\angle p$
K. $m\angle m + m\angle g = m\angle o + m\angle p$
47. If $|r| = -s$, then which of the following must be true?
- A. $r = s$
B. $r \neq s$
C. $s = 0$
D. $s \leq 0$
E. $r > 0$

GO ON TO THE NEXT PAGE.

48. Consider the three statements below to be true.

All people who like math are scientists.

Person A is not a scientist.

Person B likes math and science.

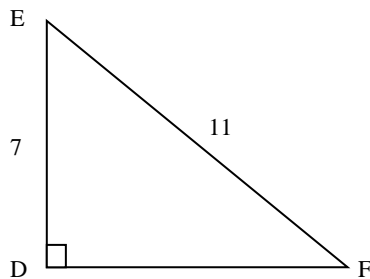
Which of the following statements is necessarily true?

- F. Person A is a scientist who does not like math.
- G. Person A is a scientist who dislikes math.
- H. Person B is not a scientist.
- J. Person B is a mathematician who likes science.
- K. Person B is a scientist.

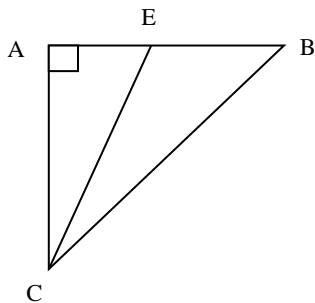
DO YOUR FIGURING HERE.

49. In $\triangle DEF$, shown below, what is the value of $\cos F$?

- A. $\frac{6\sqrt{2}}{11}$
- B. $\frac{6\sqrt{2}}{7}$
- C. $\frac{7}{11}$
- D. $\frac{7\sqrt{2}}{12}$
- E. $\frac{11}{7}$



50. In isosceles right $\triangle ABC$, \overline{EC} bisects $\angle C$. What is the measure of $\angle CEB$?



- F. 110
- G. 112.5
- H. 115.5
- J. 135
- K. Cannot be determined from the given information

GO ON TO THE NEXT PAGE.

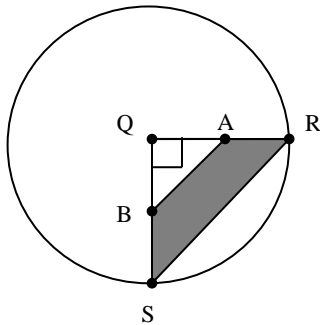
DO YOUR FIGURING HERE.

51. Which of the following is a solution for the equation $16^{x-1} = 2^{3x+2}$?

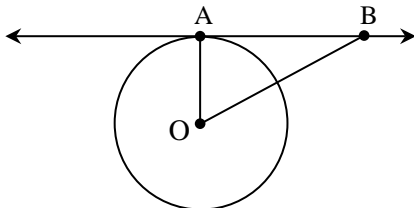
- A. -5
- B. $-\frac{1}{3}$
- C. $\frac{1}{2}$
- D. 0
- E. 6

52. The circle below with center Q has a circumference of 12π . If A is the midpoint of \overline{QR} and B is the midpoint of \overline{QS} , what is the area of the shaded region?

- F. $\frac{9}{2}$
- G. $\frac{27}{2}$
- H. 9
- J. 18
- K. 54



53. In the figure below, line AB is tangent to the circle with center O at point A. If $\overline{OB} = 2\overline{OA}$, what is the degree measure of angle ABO ?



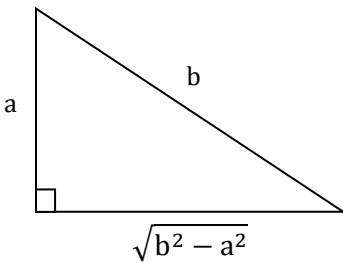
- A. 45
- B. 40
- C. 35
- D. 30
- E. 25

GO ON TO THE NEXT PAGE.

DO YOUR FIGURING HERE.

54. When a pile of bingo chips is divided evenly among 9, 10, or 12 players, there are two chips left over. What is the smallest number of bingo chips that could be in the original pile?
- F. 80
G. 182
H. 360
J. 542
K. 1080

55. If one of the angles in the right triangle shown below is $\csc^{-1}\left(\frac{b}{a}\right)$, what is $\cos\left[\csc^{-1}\left(\frac{b}{a}\right)\right]$?



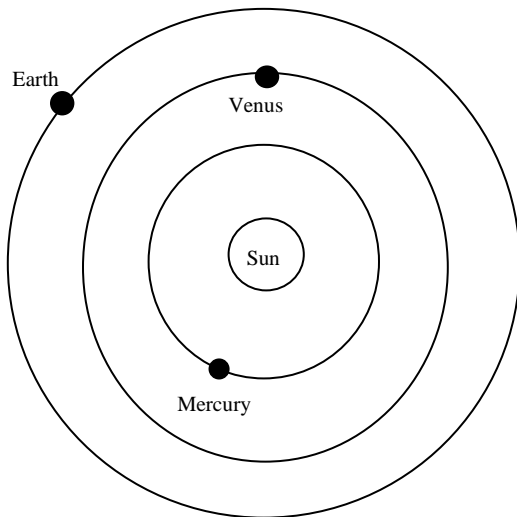
- A. $\frac{a}{b}$
B. $\frac{\sqrt{b^2 - a^2}}{b}$
C. $\frac{\sqrt{b^2 - a^2}}{a}$
D. $\frac{b}{a}$
E. $\frac{b}{\sqrt{b^2 - a^2}}$
56. Rowan's science class has five 100-point tests per semester. His score on the first four tests are 96, 95, 90, and 89. Without rounding, what is the lowest score he can receive on the fifth test to keep his average score from falling below 90?
- F. 79
G. 80
H. 81
J. 85
K. 90

GO ON TO THE NEXT PAGE.

Use the following information for questions 57-59.

DO YOUR FIGURING HERE.

The diagram below shows the orbit of the 3 planets closest to the sun in our solar system. The distance from the sun to Mercury is 5.792×10^7 km, and the distance from the sun to Earth is 1.496×10^8 km. The approximate speed of light is 300,000 km/sec.



(Note: Diagram not to scale)

57. It takes a ray of light 6.01 minutes to travel from the Sun to Venus. How far, in km, is Venus from the Sun?
- A. 1.808×10^6
 - B. 2.995×10^6
 - C. 4.327×10^7
 - D. 1.082×10^8
 - E. 6.491×10^9
58. Approximately how much longer will it take light to travel to Earth than to Mercury?
- F. 2 minutes
 - G. 3 minutes
 - H. 5 minutes
 - J. 300 minutes
 - K. 305 minutes

GO ON TO THE NEXT PAGE.

59. Assuming a circular orbit, how many kilometers long is the orbit of Earth around the Sun?

- A. 2.238×10^8
- B. 9.400×10^8
- C. 1.496×10^{16}
- D. 2.238×10^{16}
- E. 9.399×10^{16}

60. If the common ratio r is such that $0 < r < 1$, then the sum of an infinite geometric series can be determined by $\frac{a_1}{1-r}$ where a_1 is the first term in the series. What is the value of the third term of an infinite geometric series with a sum of 120 and a common ratio of .75?

- F. 1.875
- G. 16.875
- H. 22.5
- J. 50.625
- K. 90

DO YOUR FIGURING HERE.

END OF TEST