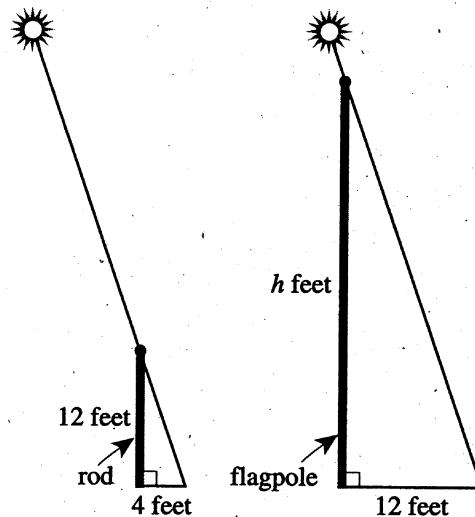


## MATHEMATICS PRACTICE TEST 4 EXPLANATORY ANSWERS

**Question 1.** The correct answer is E. You may want to make a sketch of this situation in your mind, or better yet, in the space in your test booklet. A sample sketch is shown below.



The vertical rod and the vertical flagpole each form a right angle with the level ground, resulting in 2 right triangles. The smaller right triangle (at left) is composed of the rod, the rod's shadow, and the line of sight of the Sun through the top of the rod. The larger right triangle (at right) is composed of the flagpole, the flagpole's shadow, and the line of sight of the Sun through the top of the flagpole. Since the angle of elevation of the Sun is the same for each triangle, the 2 triangles are similar by the *Angle-Angle Similarity* property. Using the ratios of corresponding sides of the similar triangles, the proportion  $\frac{12}{h} = \frac{4}{12}$  is solved to find the height of the flagpole,  $h = 36$  feet.

Common errors in this problem result from relying on an incorrect mental image or labeling the dimensions on the sketch incorrectly. If you chose A, you might have set up and solved the proportion  $\frac{h}{12} = \frac{4}{12}$ .

**Question 2.** The correct answer is H. After subtracting the onetime fee from the amount on Brendan's check ( $\$500 - \$140$ ), the remaining  $\$360$  goes toward the amount spent on monthly fees. You can find the number of months of membership covered by the check by dividing the remaining  $\$360$  by the monthly fee of  $\$40$  per month, giving 9 months as the result.

You could also solve this problem by setting up and solving the equation  $140 + 40m = 500$ , where the expression  $140 + 40m$  represents the cost of a gym membership for  $m$  months.

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**Question 3.** The correct answer is A. Substituting  $-5$  for  $x$  produces a numerator equal to  $(-5)^2 - 1 = 25 - 1 = 24$  and a denominator equal to  $-5 + 1 = -4$ . Therefore,  $\frac{x^2-1}{x+1} = \frac{24}{-4} = -6$ .

The most common wrong answer is C, which comes from forgetting the negative sign in the given  $x$ -value:  $\frac{5^2-1}{5+1} = \frac{24}{6} = 4$ .

**Question 4.** The correct answer is J. The group of 27 people paid a total of \$249.75 ( $27 \times \$9.25$  per person) in advance. Since the group consisted of more than 25 people, the actual cost was \$229.50 ( $27 \times \$8.50$  per person). The refund is the difference between the amount paid and the actual cost, which is  $\$249.75 - \$229.50 = \$20.25$ . If you chose H, you could have failed to read the problem carefully and figured the refund for a group of 25 people.

**Question 5.** The correct answer is C. The number of possible outcomes (that is, the total number of members eligible to be chosen as representative) is  $13 - 3 = 10$ , and the number of favorable outcomes (choosing Samara only) is 1. The probability of the favorable outcomes is equal to  $\frac{\text{the number of favorable outcomes}}{\text{the number of possible outcomes}}$ . So, the probability of Samara being chosen as representative would be  $\frac{1}{10}$ . Careful reading is essential; if you chose B, you may have overlooked the words CANNOT and NOT.

**Question 6.** The correct answer is H. A rectangle has 2 pairs of congruent sides. So, the rectangle has 2 side measures of 15 cm and 2 side measures of 6 cm. The perimeter of the rectangle is equal to the sum of the 4 side measures, which is  $15 + 15 + 6 + 6$ , or  $2(15 + 6) = 42$  cm. If you confused the formula for perimeter with the formula for area, you probably chose J, which was the most common incorrect answer.

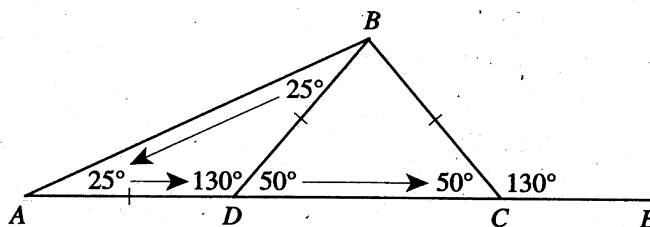
**Question 7.** The correct answer is B. The amount collected from the sale of 142 tickets bought in advance is equal to  $(\$6 \text{ per ticket})(142 \text{ tickets}) = \$852$ . The amount collected from the sale of  $d$  tickets bought at the door is equal to  $(\$8 \text{ per ticket})(d \text{ tickets}) = \$8d$ . The total amount collected from all ticket sales is  $852 + 8d$ . To determine the minimum number of tickets to produce \$2,000 in ticket sales, you can set up an inequality:  $852 + 8d \geq 2,000$ . Subtracting 852 from both sides and then dividing by 8 produces the equivalent inequality  $d \geq 143.5$ . Keep in mind, however, that  $d$  must be a whole number of tickets, so you must select the whole number  $d$  to satisfy the inequality. This means you must round 143.5 *up* to obtain the correct answer. If you chose A, you probably rounded *down* to 143. If you chose D, you might have divided 2,000 by 8 without thinking carefully about what the numbers represent. If you chose C or E, you probably set up the inequality incorrectly.

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**Question 8.** The correct answer is J. The proportion  $\frac{8}{12} = \frac{10}{r}$  is true provided that the cross product equation  $8r = 12(10)$  is true. Therefore,  $r = \frac{120}{8} = 15$ .

**Question 9.** The correct answer is E. Use of the *Distributive Property* gives the equivalent equation  $12x - 132 = -15$ . Adding 132 to both sides of the equation results in the equation  $12x = 117$ , implying that the solution is  $x = \frac{117}{12}$ , or  $\frac{39}{4}$  when reduced to lowest terms. If you distributed 12 to *only* the first term,  $x$ , but forgot to distribute 12 to the second term, you probably got an answer of  $-\frac{1}{3}$ .

**Question 10.** The correct answer is J. The figure below illustrates the progression of angle measures found in determining the measure of  $\angle BCE$ .



Because  $\overline{BD} \cong \overline{AD}$ ,  $\triangle ABD$  is isosceles, so its base angles are congruent. Therefore,  $m\angle BAD = m\angle ABD = 25^\circ$ . Because the sum of the angle measures in  $\triangle ABD$  must equal  $180^\circ$ ,  $m\angle ADB = 180^\circ - (25^\circ + 25^\circ) = 130^\circ$ . Since  $\angle ADB$  and  $\angle BDC$  are a linear pair,  $m\angle BDC = 180^\circ - 130^\circ = 50^\circ$ . Since  $\overline{BD} \cong \overline{BC}$ ,  $\triangle DBC$  is isosceles, so its base angles are congruent:  $m\angle BCD = m\angle BDC = 50^\circ$ . Finally,  $\angle BCD$  and  $\angle BCE$  are a linear pair, so  $m\angle BCE = 180^\circ - 50^\circ = 130^\circ$ .

**Question 11.** The correct answer is C. When you substitute  $-2$  for  $x$ , you get  $9(-2)^2 + 5(-2) - 8 = 9(4) + (-10) - 8 = 18$ . If you chose A, you probably evaluated  $9(-2)^2$  as  $-36$ . If you chose E, you probably evaluated  $5(-2)$  as  $10$ .

**Question 12.** The correct answer is J. One efficient way to solve this problem numerically is by listing the multiples of the largest of the 3 numbers (70) as a sequence and determining whether or not each succeeding term in the sequence is a multiple of *both* 20 and 30.

70 (multiple of neither)  
 140 (multiple of 20 only)  
 210 (multiple of 30 only)  
 280 (multiple of 20 only)  
 350 (multiple of neither)  
 420 (multiple of both 20 and 30)

The first term in the sequence that is a multiple of both 20 and 30 is 420, which is the least common multiple of 20, 30, and 70. You can also find the least common multiple by expressing each of the 3 numbers as a product of primes (with exponents), listing all bases of exponential expressions shown, and choosing for each base listed the highest-valued exponent shown.

$$\begin{aligned} 30 &= 2^1 \times 3^1 \times 5^1 \\ 20 &= 2^2 \times 5^1 \\ 70 &= 2^1 \times 5^1 \times 7^1 \end{aligned}$$

The least common multiple is  $2^2 \times 3^1 \times 5^1 \times 7^1 = 420$ .

**Question 13.** The correct answer is E. You may want to choose an even integer as Tom's initial number, follow his steps in obtaining the *incorrect* answer, and then determine *what* operation using *what* number is needed to obtain the desired number. For example:

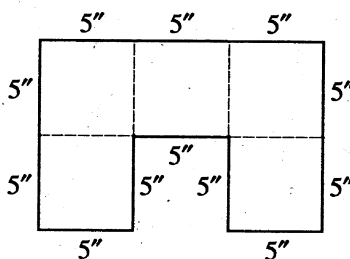
- 1) Choose the integer "6" as the initial number.
- 2) When Tom "accidentally multiplies the number by 2," he obtains an incorrect answer of 12.
- 3) Had Tom correctly divided the initial number by 2, he would have obtained 3 as the answer.
- 4) To convert his incorrect answer of 12 to the desired answer of 3, he must divide by 4.

You may want to confirm that E is the correct answer by choosing a different initial number and repeating the steps above.



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**Question 14.** The correct answer is G. The 8-sided figure in the problem consists of 5 congruent squares whose areas total 125 square inches. Therefore, each congruent square has an area of  $125 \div 5 = 25$  square inches, so each side of each square is  $\sqrt{25} = 5$  inches long. The perimeter of the 8-sided figure is composed of 12 of these sides, each of length 5 inches, as shown in the figure below. Therefore, the 8-sided figure has a perimeter of  $12 \times 5 = 60$  inches.



**Question 15.** The correct answer is E. You can solve this problem using the *Triangle Sum Theorem*. For any triangle, the sum of the measures of the 3 interior angles is  $180^\circ$ . So, for  $\triangle ABC$ ,  $m\angle A + m\angle B + m\angle C = 180^\circ$ . You are given that  $m\angle B = 90^\circ$ . So  $m\angle A + m\angle C = 90^\circ$ . Since  $m\angle A > 43^\circ$ , that means that  $m\angle C < 90^\circ - 43^\circ = 47^\circ$ .

You can also solve this problem using the following steps.

- 1) Choose a measure for  $\angle A$  that is greater than  $43^\circ$ , say  $44^\circ$ .
- 2) This implies that  $m\angle B = 180^\circ - 90^\circ - 44^\circ = 46^\circ$ .
- 3) This answer fits E.
- 4) Choose a different measure for  $\angle A$  (greater than  $43^\circ$ ) to verify that E is the correct answer.

**Question 16.** The correct answer is G. For each operation given, you can determine whether the equation is true or false by substituting the operation symbol for  $\diamond$ .

- I. Addition:  $(2 + 1)^4 + (6 + 3)^2 = 3^4 + 9^2 = 81 + 81 = 162 \neq 10$  (false)
- II. Subtraction:  $(2 - 1)^4 + (6 - 3)^2 = 1^4 + 3^2 = 1 + 9 = 10$  (true)
- III. Division:  $(2 \div 1)^4 + (6 \div 3)^2 = 2^4 + 2^2 = 16 + 4 = 20 \neq 10$  (false)

The equation is true only when the subtraction sign is substituted for  $\diamond$ .

**Question 17.** The correct answer is E. Each answer choice is a linear equation in *slope-intercept form*; that is,  $y = mx + b$ , where the value of  $m$  gives the slope of the line and the value of  $b$  gives the  $y$ -intercept of the line. Only the equation shown in E represents a line having a  $y$ -intercept ( $b = 5$ ) that matches the value of the  $y$ -intercept indicated by the given graph.

