

Name:

High School:

Lock Haven University  
Mathematics Competition for High School Students  
Tuesday April 21, 2009

**Individual Test for Grades 11 and 12**

**Directions:** *No calculators or reference materials are permitted. You may use a pencil, an eraser and your examination paper as scratch paper. Additional pencils and scratch paper will be provided if you raise your hand. In this examination all problems are multiple choice questions with five possible answers. Read each problem carefully and decide which is the best answer.*

*You will receive one point for each correct answer, and will be penalized one-fourth of a point for each incorrect answer. There is no penalty for skipping a question. Therefore it is better to leave a question unanswered if you have no idea regarding its solution.*

1. Given the function

$$f(x) = -3x + 2,$$

which of the following are true:

(i)  $f(4) = -12x + 2$

(ii)  $f(y + 1) = -(3y + 1)$

(iii)  $f(-4) = 14$

- A. (i) only.    B. (ii) only.    C. (iii) only.  
D. (i) and (ii) only.    E. (ii) and (iii) only.

2. Compare the perimeter of these polygons.

(i) A square with side 4 cm

(ii) A rectangle with length 6 cm and width 3 cm

(iii) A triangle with two sides having equal length of 4 cm each, and the length of the third side not given.

- A. (i) < (ii) < (iii)    B. (i) < (iii) < (ii)    C. (iii) < (i) < (ii)  
D. (i) = (ii) = (iii)    E. None of A, B, C, or D is correct.

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3. How far will a wheel with radius  $\frac{5}{\pi}$  roll in two revolutions?
- A. 5 units      B.  $\frac{10}{\pi}$  units      C. 10 units      D.  $\frac{25}{\pi}$  units      E. 20 units
4. If a radio station in the United States has call letters that begin with a *W* or a *K* and has four letters altogether. How many arrangements of four letters are possible as call letters?
- A.  $26^6$       B.  $2 \cdot 26^3$       C.  $26^4$       D. 80      E. 79
5. The graphs of the simultaneous equations  $x^2 + y^2 = 1$  and  $x + y = 5$  have the following number of intersection points.
- A. Infinitely many      B. 0      C. 1      D. 2      E. 3
6. If the point  $P(3, 9)$  is on the graph of a function  $f$ , find the corresponding point on the graph of the function
- $$y = \frac{1}{3}f\left(\frac{1}{2}x\right) - 1$$
- A. (2, 6)      B. (6, 2)      C.  $(\frac{3}{2}, 2)$       D. (1, 6)      E. None of A, B, C, or D
7. An object is projected vertically upward from the top of a building with an initial velocity  $32\frac{ft}{sec}$ . Its distance  $s(t)$  in feet above the ground after  $t$  seconds is given by the formula  $s(t) = -4t^2 + 32t + 25$ . What is the objects maximum distance above the ground?
- A. 89      B. 4      C. 25      D. 8      E. -89
8. If one zero of  $f(x) = x^3 - 2x^2 - 16x + 16k$  is 2, find the other zero(s).
- A. 4      B. 4 and -4      C. 2      D. 8      E. 4 and 8
9. Let  $A, B$  be sets. If  $n(A) = 14$ ,  $n(A \cap B) = 5$ , and  $n(A \cup B) = 22$ , find  $n(B)$ .
- A. 8      B. 5      C. 1      D. 13      E. 17

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10. In the land of Odd, they only use quarters, nickels, and pennies for their coins. Maria who lives in Odd likes to carry as few coins as possible. What is the minimum number of coins that Maria will carry to the store if she plans to take 117 cents?

A. 117    B. 3    C. 5    D. 8    E. 9

11. If

$$\frac{17}{x} = \frac{11}{319},$$

then the digit in the tens place of  $x$  is

A. 3    B. 9    C. 1    D. 5    E. None of A, B, C, or D.

12. A stereo was to be sold at an 18 percent discount, which amounted to 72 dollars. Which statement is true?

(i) The sale price of the stereo is 428 dollars. (ii) The original price of the stereo was 500 dollars.

A. (i) only    B. (ii) only    C. Both (i) and (ii)  
D. None of the statements are true.    E. More information is needed.

13. One of the 240 eighth grade students at Franklin Middle School is to be selected at random to win a raffle prize. If the probability of selecting a female student is  $\frac{3}{5}$ , how many male eighth grade students are there at Franklin Middle School?

A.  $\frac{2}{5}$     B.  $\frac{3}{5}$     C. 96    D. 120    E. 144

14. Rank the following from greatest to least:

$$e^e, \pi^\pi, e^\pi, \pi^e$$

A.  $\pi^\pi, \pi^e, e^\pi, e^e$     B.  $e^\pi, \pi^\pi, \pi^e, e^e$     C.  $\pi^e, \pi^\pi, e^\pi, e^e$   
D.  $e^e, \pi^\pi, e^\pi, \pi^e$     E.  $\pi^\pi, e^\pi, \pi^e, e^e$

15. When the length of each of the edges of a cube is increased by 1  $cm$ , the cube's total surface area increases by 78  $cm^2$ . What is the length of an edge of the original?

A. 4 $cm$     B. 5 $cm$     C. 6 $cm$     D. 7 $cm$     E. None of the above