WWTAM 2014 Round One National Contest Qualifying Test

(answers in red)

1. Solve for x: $2x^3 + 9x^2 = 35x$.
   0, 5/2, -7

2. Find $\sec^2(\theta)$ if $\tan(\theta) = -\sqrt{2}$.
   3

3. How many (positive integer) factors does 1000 have (including 1 and itself)?
   16

4. What is the coefficient of the x^2y^3 term in the expansion of $(2x - y)^5$?
   -40

5. An equilateral triangle is inscribed in a circle of radius 1. What is the area of the region inside the circle but outside the triangle?
   $\pi - \frac{3\sqrt{3}}{4}$

6. The 19th century mathematician Niels Abel was born in what is now
   a. England
   b. France
   c. Norway
   d. Scotland

7. Two cards are drawn without replacement from a standard deck of 52 cards. What is the probability that both are of the same suit?
   $4/17$ (or any fraction equal to 4/17)

8. The hypotenuses of two right triangles have the same length. The ratio of the lengths of the legs of the first triangle is 4:3 while the ratio of the lengths of the legs of the second triangle is 16:9. Which of the following is true about the length of the smallest side of the first triangle divided

by the length of the smallest side of the second triangle? (Again, just enter the letter of your answer.)

a. It's between ½ and ¾
b. It's between ¾ and 1
c. It's between 1 and 5/4
d. It's greater than 5/4

9. Suppose *a* and *b* are positive integers greater than 1. If $\log_a \sqrt{b} = s$ then what is $\log_b(a^2)$?
1/s

10. What is the largest number that cannot be written in the form 6*a* + 9*b* + 20*c,* where *a, b*, and *c* are non-negative integers? (Again, just enter the letter of your answer.)

a. 22
b. 23
c. 28
d. 37
e. 43