

# Math Field Day

## Mad Hatter 9-10 sample questions

(taken from previous years)

**Note:** the problems given below are examples of problems given in previous years. They do not cover all the topics that can occur on the contest this year. They are only intended to give you a rough idea of the difficulty of the problems that may be given.

1. Point  $P$  is on the number line. The distance between 0 and  $P$  is four times the distance between  $P$  and 30. What is the sum of the two possible values?

- (a) 40
- (b) 24
- (c) 64
- (d) None of the above

2. Simplify:  $\frac{(y^5)^2(x^2)^6}{(y^3x^4)(y^2x^3)^3}$

- (a)  $\frac{x}{y}$
- (b)  $\frac{x^2}{y}$
- (c)  $\frac{y^2}{x}$
- (d)  $\frac{y}{x}$

3. Find the product of the roots of  $2x^2 + 3x - 4 = 0$

- (a) 2
- (b)  $\frac{1}{2}$
- (c)  $-\frac{1}{2}$
- (d) -2

4. Solve for  $x$ :  $|x + 3| > 7$
- (a)  $-4 < x < 4$
  - (b)  $x > 4$
  - (c)  $x < 0$
  - (d) None of the above
5. Find the probability of drawing a “King” or “Queen” out of a standard deck of 52 cards.
- (a)  $\frac{1}{4}$
  - (b)  $\frac{1}{26}$
  - (c)  $\frac{2}{13}$
  - (d)  $\frac{1}{13}$
  - (e) None of the above
6.  $\frac{\log_7 10}{\log_7 100} =$
- (a) 2
  - (b)  $-\frac{1}{2}$
  - (c)  $\frac{1}{2}$
  - (d)  $-2$
  - (e) None of the above
7. Let  $f(x) = x^2 + 6x + 1$ , and let  $R$  denote the set of points  $(x, y)$  in the coordinate plane such that  $f(x) + f(y) \leq 0$  and  $f(x) - f(y) \leq 0$ . The area of  $R$  is closest to
- (a) 25
  - (b) 24
  - (c) 23
  - (d) None of the above
8. Find the number of terms of the finite arithmetic progression 7, 10, 13, ..., 55.
- (a) 15
  - (b) 16
  - (c) 17
  - (d) 7

9. Find  $\left(-\frac{1}{2} + \frac{\sqrt{3}}{2}i\right)^3$

(a)  $-1$

(b)  $1$

(c)  $1 + i$

(d)  $\frac{1}{2} + \frac{1}{2}i$

10. Simplify  $1 + \frac{1}{1 + \frac{1}{1-x}}$

(a)  $\frac{1-2x}{x}$

(b)  $\frac{2-x}{x}$

(c)  $\frac{2x-1}{x}$

(d) None of the above

11. If a circle has an area of  $\frac{125}{\pi}$ , what is its diameter?

(a)  $\frac{5\sqrt{10}}{\pi}$

(b)  $\frac{\pi^2}{125}$

(c)  $\frac{10\sqrt{5}}{\pi}$

(d) None of the above

12. Find  $1 + 2 + 4 + 8 + 16 + \dots + 16384 =$

(a)  $27673$

(b)  $27637$

(c)  $32767$

(d) None of the above

13. Find the slope of the line  $3x + 4y = 11$

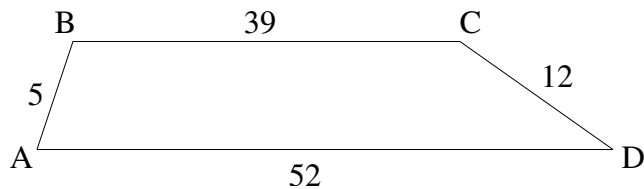
(a)  $\frac{3}{4}$

(b)  $\frac{4}{3}$

(c)  $-\frac{3}{4}$

(d) None of the above

14. In the trapezoid  $ABCD$  with bases  $BC$  and  $AD$ , we have  $AB = 5$ ,  $BC = 39$ ,  $CD = 12$ , and  $DA = 52$ . The area of  $ABCD$  is



(a) 182

(b) 195

(c) 210

(d) 260

15. Five men meet. All shake hands with each other. How many hand shakes are there altogether?

(a)  $5^2$

(b)  $2^5$

(c) 10

(d) None of the above

16. How many of the positive integers that are less than 2003 have an odd number of positive factors?

(a) 45

(b) 103

(c) 40

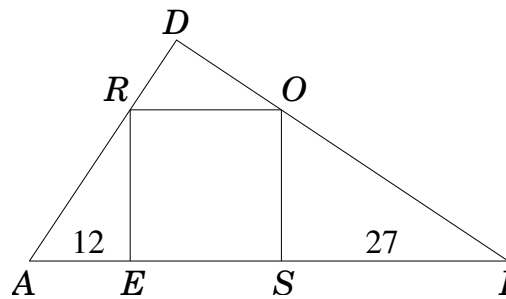
(d) None of the above

17. The ratio  $\frac{10^{2000} + 10^{2002}}{10^{2001} + 10^{2001}}$  is closest to which of the following numbers?
- (a) 0.1
  - (b) 0.2
  - (c) 5
  - (d) None of the above
18. 2.4 is what percent of 1.6?
- (a) 50
  - (b) 125
  - (c) 175
  - (d) None of the above
19. Solve for  $x$ :  $\frac{1}{x} + \frac{1}{3} = \frac{3}{4x} + \frac{1}{2}$
- (a)  $\frac{2}{3}$
  - (b)  $-\frac{2}{3}$
  - (c)  $\frac{3}{2}$
  - (d)  $-\frac{3}{2}$
20. The angles of a hexagon have degree measures that are consecutive odd integers. What is the degree measure of the largest angle?
- (a) 119
  - (b) 57
  - (c) 125
  - (d) None of the above

21. In a group of 30 people there are 20 women and 10 men. The average height of the women is 66" and the average height of the men is 69". What is the average height of the 30 people?

- (a) 67"
- (b) 67.5"
- (c) 68"
- (d) 68.5"
- (e) None of the above

22. Find the area of square  $ROSE$  which is inscribed in right triangle  $ADI$ , if  $AE = 12$  and  $SI = 27$ .



- (a) 729
- (b) 144
- (c) 324
- (d) None of the above