Math Field Day

Mad Hatter B 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" our 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 $f(x) + f(y) \le 0$ and $f(x) f(y) \le 0$. 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 $1 + \frac{1}{1 + \frac{1}{1 r}}$
 - (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 $1 + 2 + 4 + 8 + 16 + \ldots + 16384 =$
 - (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 AB and CD, we have AB = 52, BC = 12, CD = 39, and DA = 5. 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