

## Math Challenge 2010 - Multiple Choice Questions

1) If you were to guess randomly, what is the probability that you would answer this question incorrectly?

- a)  $\frac{1}{4}$                       b)  $\frac{1}{2}$                       c)  $\frac{3}{4}$                       d) 1

2)  $\frac{1}{2}$  of  $\frac{1}{3}$  of  $\frac{1}{4}$  of 48 is

- a) 2                      b) 52                      c)  $\frac{1}{2}$                       d)  $\pi$

3)  $\frac{\sqrt{12}}{\sqrt{8}} =$

- a)  $\frac{\sqrt{3}}{\sqrt{2}}$                       b)  $\left(\sqrt{\frac{2}{3}}\right)^{-1}$                       c)  $\frac{\sqrt{6}}{2}$                       d) all of a), b) and c)

4) You invest \$5. It earns 5% annual interest, compounded annually, for 5 years. Your investment is then worth

- a) \$10.00                      b) \$6.25                      c) \$6.38                      d) \$12.50

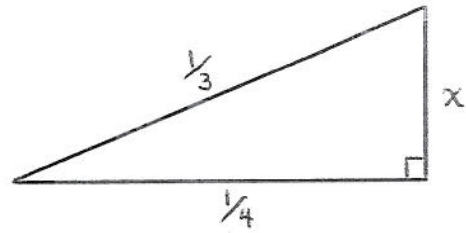
5) The smallest angle between the hour hand and the minute hand of a clock at 8:45 is

- a)  $7.5^\circ$                       b)  $5^\circ$                       c)  $10^\circ$                       d)  $15^\circ$

6)  $\frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}} =$

- a) 1                      b) -1                      c)  $\sqrt{5}$                       d)  $5 + 2\sqrt{6}$

7)  $x =$



a)  $\frac{5}{12}$

b)  $\frac{1}{12}$

c)  $\frac{\sqrt{7}}{12}$

d)  $\frac{\sqrt{11}}{50}$

8) The sum of all of the prime number factors of 2010 is

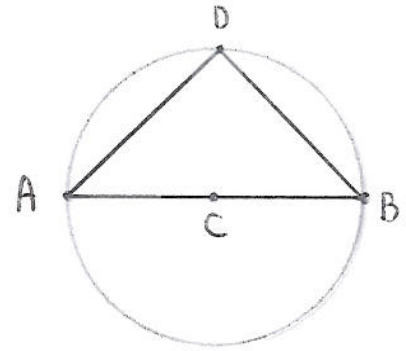
a) 211

b) 77

c) 23

d) none of a), b) or c)

9) The area of the circle with center C is  $400\pi$ . If triangle ADB is isosceles, then the area of this triangle is



a) 200

b)  $200\sqrt{2}$

c) 400

d)  $400\sqrt{2}$

10) Assume  $a$ ,  $b$  and  $c$  are non-zero. The slope of the line  $\frac{1}{a}x + \frac{1}{b}y + \frac{1}{c} = 0$  is

a)  $\frac{a}{b}$

b)  $\frac{b}{a}$

c)  $-\frac{a}{b}$

d)  $-\frac{b}{a}$

11) A circle has radius  $r$ . If its radius is increased to  $r + 1$ , then its circumference increases by

a)  $2\pi$

b)  $\pi$

c) 2

d) cannot be determined from the given information

12) A box that measures 20 cm by 200 mm by 2 m contains how many  $\text{cm}^3$ ?

a) 8000

b) 80,000

c) 800

d) 800,000

13) It was recently proposed that the income tax rate in a local city be raised from 1.3% to 1.5%. What is the percentage increase in this income tax rate?

- a) 0.2%                      b) 15.38%                      c) 15.33%                      d) 20%

14) Assume that  $x > 0$  and  $y > 0$ . Then  $\sqrt{x} + \sqrt{y} - \sqrt{x + y}$  is always

- a) zero                      b) negative                      c) positive                      d) not a real number

15) A fair coin is flipped six times in succession. The probability that it come up heads at least once is approximately

- a) 16.67%                      b) 83.33%                      c) 98.44%                      d) 1.56%

16) The volume of a sphere of radius  $r$  is given by  $V = \frac{4}{3} \pi r^3$ . The volume of the same sphere in terms of its diameter  $d$  is

- a)  $\frac{2}{3} \pi d^3$                       b)  $\frac{8}{3} \pi d^3$                       c)  $\frac{32}{3} \pi d^3$                       d)  $\frac{1}{6} \pi d^3$

17) Alice, working alone, can do a job in 8 hours. Bob can do the same job by himself in 10 hours, while Chris would take 12 hours. If all three of them work together, approximately how long would it take them to do this job?

- a) 3.24 hours                      b) 3.33 hours                      c) 10 hours                      d) 30 hours

18) The number of prime numbers between 100 and 110 is

- a) 2                      b) 3                      c) 4                      d) 5

19) The operation # is defined by  $x \# y = x^2 y$ . The operation @ is defined by  $x @ y = y - x^2$ . What is  $(3 @ 1) \# (2 @ 0)$  ?

- a) 0                      b) 8                      c) -256                      d) 256

20) Recall that we define  $n!$  by  $n! = n(n-1)(n-2) \cdots 4 \cdot 3 \cdot 2 \cdot 1$ . The value of  $\frac{500!}{498!}$  is

- a) 2                                  b)  $(1.004016)!$                   c) 249,500                          d) impossible to compute

21) On February 9 – 10, 2010, approximately 11 inches of snow fell on Kent County, which is a rectangle 24.1 miles wide and 35.5 miles long. If there are eighty snowflakes in a cubic centimeter, approximately how many snowflakes fell on Kent County? (1 mile = 5280 feet, 1 foot = 12 inches, 1 inch = 2.54 centimeters)

- a)  $1.21 \times 10^{11}$                           b)  $1.85 \times 10^{21}$                           c)  $7.75 \times 10^{14}$                           d)  $4.95 \times 10^{16}$

22)  $\frac{1}{\frac{1}{x} - \frac{1}{y}} =$

- a)  $x - y$                                   b)  $y - x$                                   c)  $\frac{xy}{y - x}$                                   d)  $\frac{y - x}{xy}$

23) The slope of any line perpendicular to  $x = 4$  is

- a)  $-\frac{1}{4}$                                   b) 0    c) undefined                                  d)  $\frac{1}{4}$

24)  $-4^2 - 2(3 - (-1)) - \frac{4}{3 - 2^2} =$

- a) -20                                  b) 12    c)  $-\frac{88}{3}$     d)  $\frac{8}{3}$

25) A number  $n$  is increased by 100%. The result is then decreased by 100%. Then this last result is increased by 100%. The final value is

- a)  $n$     b)  $2n$     c)  $100n$     d) 0

26) In order to log-in to a certain secure site on the Internet, a five-character password is required. Each character may be any letter from A – Z or any numeral from 0 – 9 (repetition is allowed). How many possible passwords are there?

- a) 60,466,176                      b)  $1.455 \times 10^{25}$                       c) 45,239,040                      d)  $3.712 \times 10^{41}$

27) A circle of radius  $r$  is centered at  $(0,0)$ . The point  $(m,n)$  is on the circle. The slope of the line tangent to the circle at the point  $(m,n)$  is

- a)  $\frac{n}{m}$                                       b)  $\frac{m}{n}$                                       c)  $-\frac{n}{m}$                                       d)  $-\frac{m}{n}$

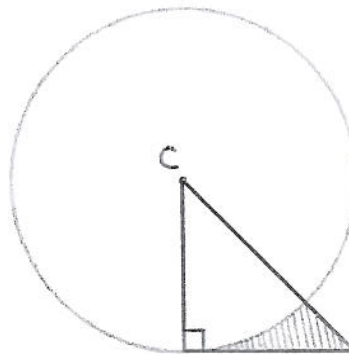
28) The circumference of the circle  $x^2 + y^2 + 2x + 4y = 0$  is

- a)  $10\pi$                                       b)  $2\sqrt{5}\pi$                                       c) 0                                      d)  $2\sqrt{3}\pi$

29) If there are 14 pounds in one stone, 43 stones in 2 pigs, and 8 pigs in one fother, then 2000 pounds is approximately how many fothers? (These were all legitimate units of measure in the U.S. in 1870.)

- a) 9,632,000                                      b) 0.42                                      c) 0.83                                      d) 4,816,000

30) The circle centered at C has radius  $r$ , and the right triangle is isosceles. The area of the shaded region is



- a)  $\frac{4 - \pi}{8} r^2$                                       b)  $\frac{\pi - 2}{4} r^2$                                       c)  $\frac{8 - \pi}{8} r^2$                                       d)  $\frac{4 - \pi}{4} r^2$

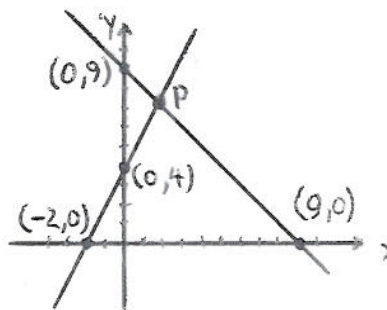
31) Recall that the month of March has 31 days. Suppose that today's date for this mathematics competition, the 13<sup>th</sup>, was chosen because 13 is an odd number. If three dates are chosen at random in March (without repetition), what is the approximate probability that all three are odd numbers?

- a) 12.5%                      b) 9.7%                      c) 51.6%                      d) 13.7%

32) If one uses  $\sqrt{3} + \sqrt{2}$  for the numerical value of  $\pi$ , what is the percent error in this approximation?

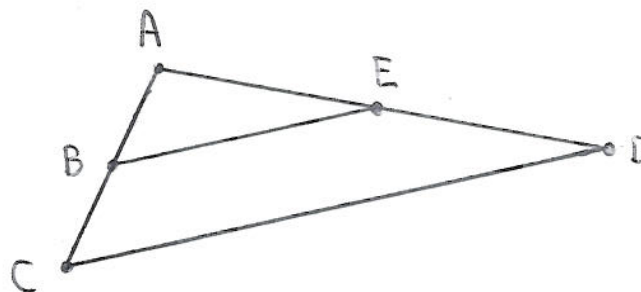
- a) 0.467%                      b) 0.149%                      c) 0.00467%                      d) 0.00149%

33) The point of intersection P of the two lines shown in the graph is exactly



- a) (2,7)                      b)  $(\frac{5}{3}, \frac{22}{3})$                       c)  $(\frac{3}{2}, \frac{13}{2})$                       d)  $(\frac{7}{4}, \frac{29}{4})$

34) If B bisects segment AC and E bisects segment AD, then the ratio of the area of triangle ABE to the area of triangle ACD is



- a)  $\frac{1}{4}$                       b)  $\frac{1}{3}$                       c)  $\frac{1}{2}$                       d)  $\frac{2}{5}$

35) If the equation  $y + r + y^2 = r^2$  is solved for y, then the sum of the solutions is

- a) 1                      b) 2r                      c) -1                      d) -2r

Answers:

- 1) c)
- 2) a)
- 3) d)
- 4) c)
- 5) a)
- 6) d)
- 7) c)
- 8) b)
- 9) c)
- 10) d)
- 11) a)
- 12) b)
- 13) b)
- 14) c)
- 15) c)
- 16) d)
- 17) a)
- 18) c)
- 19) c)
- 20) c)
- 21) d)
- 22) c)
- 23) b)
- 24) a)
- 25) d)
- 26) a)
- 27) d)
- 28) b)
- 29) c)
- 30) a)
- 31) a)
- 32) b)
- 33) b)
- 34) a)
- 35) c)