

MATH SCIENCE BOWL QUESTIONS - 23 OCTOBER 2012  
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**TOSS UP**

1) MATH *Multiple Choice* The length of the remaining leg in a right triangle with a hypotenuse of 13 and a leg of 5 is

- W) 10
- X) 11
- Y) 12
- Z) 13

ANSWER: Y) 12

**TOSS UP**

2) MATH *Short Answer* What is the first derivative of the expression  $2x^3 + x^2 - 7$ ?

ANSWER:  $6x^2 + 2x$

**TOSS UP**

3) MATH *Multiple Choice* The first derivative of the expression  $1/x^3$  is

- W)  $-4x^{-3}$
- X)  $-3x^{-4}$
- Y)  $-2x^{-3}$
- Z)  $-3x^{-2}$

ANSWER: X)  $-3x^{-4}$

**TOSS UP**

4) MATH *Short Answer* Given functions  $v(x)$  and  $u(x)$ , use the Chain Rule to find  $v(u(x))'$ .

ANSWER:  $v'(u(x))u'(x)$  OR  $u'(x)v'(u(x))$

**TOSS UP**

5) MATH *Multiple Choice* The first derivative of the expression  $e^x$  is

- W)  $e^x$
- X)  $e^{(2x)}$
- Y)  $x^e$
- Z)  $x^{(2e)}$

ANSWER: W)  $e^x$

**TOSS UP**

6) MATH *Short Answer* If  $x$  and  $y$  are integers such that  $x^y = 1$  and  $xy = 1$ , what is the value of  $y^x$ ?

ANSWER: 1

**TOSS UP**

7) MATH *Multiple Choice* The expression  $(-x)(-x)(-x)$  is equivalent to

- W)  $-3x^3$
- X)  $-3x$
- Y)  $-x^3$
- Z)  $3x$

ANSWER: Y)  $-x^3$

**TOSS UP**

8) MATH *Short Answer* The value of  $4.23 \cdot 10^k$  lies between 400 and 500. If  $k$  is an integer, what is the value of  $k$ ?

ANSWER: 2

**TOSS UP**

9) MATH *Multiple Choice* A triangle with a perimeter of 20 has a side of length 5. A possible length for a second side of a triangle is

- W) 5
- X) 7
- Y) 10
- Z) 12

ANSWER: X) 7

**TOSS UP**

10) MATH *Short Answer* A square with an area of 2 is inscribed in a circle. What is the area of the circle? Leave in terms of  $\pi$ .

ANSWER:  $2\pi$

**TOSS UP**

11) MATH *Multiple Choice* What is the result when 5 times  $t$  is decreased by 8?

- W)  $8-5t$
- X)  $5t-8$
- Y)  $5(t-8)$
- Z)  $5(8-t)$

ANSWER: X)  $5t-8$

**TOSS UP**

12) MATH *Short Answer* There are how many prime numbers under 20?

ANSWER: 8

**TOSS UP**

13) MATH *Multiple Choice* If  $a^2 + 2ab + b^2 = 5$  and  $a^2 + b^2 = 3$ , then  $ab$  is equal to

- W) 1
- X) 2
- Y) 3
- Z) 4

ANSWER: W) 1

**TOSS UP**

14) MATH *Short Answer* What is the formula for the circumference of a circle? Express in terms of  $C$  and  $r$ .

ANSWER:  $C = 2\pi r$

**TOSS UP**

15) MATH *Multiple Choice* What is the name for two circles with the same center?

- W) Congruent
- X) Concentric
- Y) The same
- Z) Target

ANSWER: X) Concentric

**TOSS UP**

16) MATH *Short Answer* What is the volume of a circle with a radius of 3? Express in terms of  $\pi$ .

ANSWER:  $36\pi$

**TOSS UP**

17) MATH *Multiple Choice* What is the area of a square with diagonal  $x$ ?

- W)  $x^2$
- X)  $2x$
- Y)  $x$
- Z)  $x^2/2$

ANSWER: Z)  $x^2/2$

**TOSS UP**

18) MATH *Short Answer* If  $3x/4 = 9/16$ , then what is the value of  $x$ ?

ANSWER:  $3/4$

**TOSS UP**

19) MATH *Multiple Choice* What is the median of the data set:  
 $\{1, 3, 4, 6, 7\}$ ?

- W) 1
- X) 3
- Y) 4
- Z) 6

ANSWER: Y) 4

**TOSS UP**

20) MATH *Short Answer* Expand:  $(x+2)^2$

ANSWER:  $x^2+4x+4$

**TOSS UP**

21) MATH *Multiple Choice* What degree is the expression  
 $x^5+x^3+x^2+x+x^7+2$ ?

- W) 1
- X) 3
- Y) 5
- Z) 7

ANSWER: Z) 7

**TOSS UP**

22) MATH *Short Answer* What is the integral of  $e^x$ ?

ANSWER:  $e^x$

**TOSS UP**

23) MATH *Multiple Choice* Given a pair of fair dice, what is the probability that a random roll will return a pair of 6's?

- W)  $1/36$
- X)  $1/12$
- Y)  $1/6$
- Z)  $1/3$

ANSWER: W)  $1/36$

**TOSS UP**

24) MATH *Short Answer* What is the perimeter of a square with a circle of radius 5 inscribed?

- W) 20
- X) 30
- Y) 40
- Z) 50

ANSWER: Y) 40

**TOSS UP**

25) MATH *Multiple Choice* The sin of  $\pi/2$  is equal to:

- W) 0
- X)  $1/3$
- Y)  $1/2$
- Z) 1

ANSWER: W) 0

**BONUS**

26) MATH *Multiple Choice* Assuming the Fibonacci sequence begins with the terms 1, 1, and 2, the 10th term of the Fibonacci sequence is

- W) 21
- X) 34
- Y) 55
- Z) 89

ANSWER: Y) 55

**BONUS**

27) MATH *Short Answer* What is the mean for a set of data consisting of the elements: {2,3,4,5,6,6,6,7,8,9,10}?

ANSWER: 6

**BONUS**

28) MATH *Multiple Choice* What is the probability of choosing a heart from a deck of cards given that the card is red?

- W) 0
- X)  $1/2$
- Y)  $3/4$
- Z) 1

ANSWER: X)  $1/2$

**BONUS**

29) MATH *Short Answer* What is the final balance after 4 years of continuous compounding interest if the rate is 0.4 and the initial balance is 4000? Do not evaluate e.

ANSWER:  $4000e^{1.6}$

**BONUS**

30) MATH *Multiple Choice* Assuming the first term of the Fibonacci sequence is 1, the 20th term of the Fibonacci sequence is:

- W) 6765
- X) 4181
- Y) 2584
- Z) 1597

**BONUS**

31) MATH *Short Answer* What is the fifth prime Fibonacci number?

ANSWER: 89

**BONUS**

32) MATH *Multiple Choice* What is the fifth triangular number?

- W) 6
- X) 10
- Y) 15
- Z) 21

ANSWER: Y) 15

**BONUS**

33) MATH *Short Answer* What is the probability that a six is shown on one die but not the other when two dice are rolled? Give answer in fraction form.

ANSWER: 5/18

**BONUS**

34) MATH *Multiple Choice* Solve for x:  $9x^3+6x^2+6x+4=0$

- W) 1
- X)  $2/3$
- Y) -1
- Z)  $-2/3$

ANSWER: Z)  $-2/3$



**BONUS**

35) MATH *Short Answer* A sequence of numbers contains all positive integers such that integer  $a_n$  is equal to  $a_{n-1}+a_{n-2}$ . What is the name of this series?

ANSWER: Fibonacci sequence

**BONUS**

36) MATH *Multiple Choice* What is the golden ratio  $\phi$  rounded to the nearest tenth place?

W) 1.5

X) 1.6

Y) 1.7

Z) 1.8

ANSWER: X) 1.6

**BONUS**

37) MATH *Short Answer* What is the formula for the surface area of a sphere? Express in terms of  $A$ ,  $\pi$ , and  $r$ .

ANSWER:  $A=4\pi r^2$

**BONUS**

38) MATH *Multiple Choice* Which is a possible solution for  $x$  in the equation  $|x+32|=76$ ?

W) -108

X) 108

Y) -44

Z) 43

ANSWER: W) -108

**BONUS**

39) MATH *Short Answer* If  $a^2b/(2a)=3/2$ , then what is  $ab$ ?

ANSWER: 3

**BONUS**

40) MATH *Multiple Choice* If  $x^2+8x \leq -15$ , which of the following is a possible value of  $x$ ?

- W) -6
- X) -4
- Y) -2
- Z) 0

ANSWER: X) -4

**BONUS**

41) MATH *Short Answer* The measure of the largest angle in a certain triangle is twice the sum of the measures of the remaining angles. What is the measure of the largest angle? Express the answer in degrees.

ANSWER:  $120^\circ$

**BONUS**

42) MATH *Multiple Choice* In the equation  $y=x+2k$ ,  $y=2$  when  $x=5$ . What is the value of  $y$  when  $x=3$ ?

- W) 0
- X) 1
- Y) 2
- Z) 3

ANSWER: W) 0

**BONUS**

43) MATH *Short Answer* If  $\cos(x) = y^2$ , what is  $y$  when  $x = \pi$ ?

ANSWER:  $i$

**BONUS**

44) MATH *Multiple Choice* If  $x$  is a two-digit number whose units digit is 4 times its tens digit, which of the following statements is true?

- W)  $x$  is greater than 70
- X)  $x$  is greater than 60
- Y)  $x$  is greater than 50
- Z)  $x$  is greater than 40

ANSWER: Z)  $x$  is greater than 40

**BONUS**

45) MATH *Short Answer* In the  $xy$ -plane, a curve passes through the points  $(0,0)$  and  $(4,0)$ . What is the equation of least degree that satisfies this condition?

ANSWER:  $y = (x-2)^2 - 4$

**BONUS**

46) MATH *Multiple Choice* If  $xy = 5$ ,  $xz = 10$ ,  $yz = 2$ , and  $x$ ,  $y$ , and  $z$  are positive, what is the value of  $xyz$ ?

- W) 5
- X) 10
- Y) 20
- Z) 25

ANSWER: X) 10

**BONUS**

47) MATH *Short Answer* What is the 10th triangular number?

ANSWER: 55

**BONUS**

48) MATH *Multiple Choice* A series contains the numbers  $\{3/2, 9/4, 81/16\}$ . Which number should follow?

- X)  $81/2$
- Y)  $6561/256$
- X)  $6332/255$
- Z)  $1/4$

ANSWER: Y)  $6561/256$

**BONUS**

49) MATH *Free Response* A right angle is divided into three nonoverlapping angles whose measures are  $2x^\circ$ ,  $3x^\circ$ , and  $5x^\circ$ . What is the value of  $x$ ?

ANSWER: 9

**BONUS**

50) MATH *Multiple Choice* What is the balance after 3 years at a continuously compounding interest rate of 0.6 and an initial balance of 2000? Do not evaluate  $e$ .

- W)  $2000e^{1.8}$
- X)  $1000e^{1.8}$
- Y)  $500e^{1.8}$
- Z)  $250e^{1.8}$

ANSWER: W)  $2000e^{1.8}$