TOSS-UP (All math questions)

1) MATH *Multiple Choice* What is the dot product of the vectors 2i + 3j and -4i + 5j?

ANSWER: 7

# BONUS

1) MATH *Short Answer* What is the cross product of the vectors 3i + 5j + 8k and -2i – 3j – 5k?

ANSWER: - i + j + k

# TOSS-UP

2) MATH *Multiple Choice* The length of a rectangle is 15 meters and the width is 20 meters. What is the perimeter of the square?

ANSWER: 70 meters

# BONUS

2) MATH *Short Answer* What is the length of a diagonal of this rectangle?

ANSWER: 25 meters

**TOSS-UP**

3) The sum of two numbers is 21. Their product is 98. What are the two numbers?

ANSWER: 13 and 5

# BONUS

3) The sum of three numbers is 18. Their product is 210. What are the numbers?

ANSWER: 5, 6, and 7

# TOSS-UP

4) What is cos 120?

W) ½

X) (sqrt 3)/2

Y) -1/2

Z) –(sqrt3)/2

ANSWER: Y) -1/2

# BONUS

4) What is tan (5pi) / 3?

ANSWER: - sqrt 3

**TOSS-UP**

5) MATH *Short Answer* How many distinct prime factors does 30 have?

W) 1

X) 2

Y) 3

Z) 4

ANSWER: Y) 2

# BONUS

5) MATH *Short Answer* What is the distinct factorization of 540?

ANSWER: 2^2 x 3^3 x 5

# TOSS-UP

6) MATH *Short Answer* If the dot product of two vectors is zero, what does it say about the vectors?

W) They are parallel

X) They are perpendicular

Y) They are skew

Z) They intersect at the origin

ANSWER: X) They are perpendicular

# BONUS

6) What is the Cartesian equation of the plane passing through the point (5, 2, 1) and with the normal vector 4i + 3j - 2k.

ANSWER: 4x + 3y – 2z = 24

**TOSS-UP**

7) How many copies of -4x + 3y must be added together to get -24x + 18y?

ANSWER: 6

# BONUS

7) What is a vector perpendicular to (-4, 3)?

ANSWER: (3, 4)

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# TOSS-UP

8) Nine cards are numbered 1 through 9. What is the probability of selecting a card with a number greater than 4 or an even number?

W) 1/3

X) 4/9

Y) 2/3

Z) 7/9

ANSWER: Z) 7/9

# BONUS

8) There are four pieces of colored paper, which are red, yellow, blue, and green. They are selected without replacement. What is the probability that the yellow piece is drawn first and the blue is drawn last?

ANSWER: 1/12

**TOSS-UP**

9) How many cubes that are 1 inch by 1 inch by 1 inch dimensions will pack into a rectangular box with dimensions 8”, 6”, and 6.5” ?

W) 288

X) 312

Y) 326

Z) 340

ANSWER: W) 288

# BONUS

9) Set A contains 20 elements, Set B contains 14 elements, and the intersection of the sets contains 9 elements. How many elements are in the union of the sets.

ANSWER: 25

# TOSS-UP

10) For every $50 deposited into a bank, $30 goes into a checking account and $20 goes into a savings account. When $200 is deposited, how much is deposited into the checking account?

ANSWER: $120

# BONUS

10) What value of x satisfies this equation: x/x – x/12 = x/24

ANSWER: 8

**TOSS-UP**

11) 3 people split the cost of a pizza. If one person paid $3.24, then what is the price of the whole pizza?

ANSWER: $9.72

# BONUS

11) There are two equal piles of marbles. Three of the marbles are taken from one of the marbles, leaving 28 marbles. How many marbles are there total?

ANSWER: 62

# TOSS-UP

12) A right triangle has leg lengths of 7 and 24. A similar triangle has a hypotenuse of 100 units. What is the length in units of the shorter leg of the second triangle?

W) 24

X) 28

Y) 48

Z) 96

Answer: X) 28

# BONUS

12) A number’s thousands digit is 2, the hundreds digit is 0, and the units digit is 7. What number must be placed in the tens place to make the number a multiple of 11?

W) 1

X) 5

Y) 7

Z) 9

ANSWER: X) 5

**TOSS-UP**

13) What is -15 + 9 x (6 + 3)

ANSWER: 66

# BONUS

13) The mean of 5 positive integers is 7. If all of the numbers are different, what is the greatest possible number in the group?

ANSWER: 25

# 

# TOSS-UP

14) What percent of 20 is 66?

ANSWER: 330

# BONUS

14) What is the positive difference between the two solutions of |x+5| = 20

ANSWER: 40

**TOSS-UP**

15) A board game spinner has three regions, A, B, and C. The probability of the arrow landing on A is 1/3 and B is ½. What is the probability of the arrow stopping on region C?

ANSWER: 1/6

# BONUS

15) If x and y are the greatest and least positive two-digit multiples of 13, what is x + y?

ANSWER: 104

# TOSS-UP

16) If a triangle has two sides of length 5 and 7 units, how many lengths can the third side be?

ANSWER: 9

# BONUS

16) What is the first perfect square greater than 1 in the Fibonacci sequence, defined by 1, 1, 2, 3, 5, 8, …

W) 144

X) 169

Y) 225

Z) 17,711

ANSWER: W)144

**TOSS-UP**

17) Find the sum of 5 + 4i, -1 + 2i, and 7

ANSWER: 11 + 6i

# BONUS

17) What is (3-4i)(5+2i)

ANSWER: 23 – 4i

# TOSS-UP

18) What is 7^2010, mod 8?

W) 1

X) 2

Y) 6

Z) 7

Answer: W) 1

# BONUS

18) What is the remainder when 9 x 99 x 999 x 9999 x 99999 x 999999 is divided by 100?

W) 9

X) 45

Y) 81

Z) 91

ANSWER: Z) 91

**TOSS-UP**

19) What theorem states that a^(p-1) = 1 (mod p)

W) Fermat’s Last Theorem

X) Fermat’s Little Theorem

Y) Wilson’s Theorem

Z) Ceva’s Theorem

ANSWER: X) Fermat’s Little Theorem

# BONUS

19) Give log2056x/9 in logarithmic form.

ANSWER: log2056 + log20 x – log20 9

# TOSS-UP

20) What is e^(pi x i) equal to?

W) Undefined

X) 0

Y) -1

Z) e

ANSWER: Y) -1

# BONUS

20) If a sample of uranium decays from 96 grams to 12 grams in 4 hours, what is its halflife?

ANSWER: 1 hour 20 minutes

**TOSS-UP**

21) What is the velocity of a person if the slope of the displacement graph is 3 m per second?

W) 3 m/s

X) 6 m/s

Y) 9 m/s

Z) 12 m/s

Answer: W) 3 m/s

# BONUS

21) A person runs on a straight path at a constant speed of 3 m/s. Then he runs back on the same path at a constant speed of 6 m/s. What is his average speed?

W) 3 m/s

X) 4 m/s

Y) 4.5 m/s

Z) 6 m/s

ANSWER: X) 4 m/s

# TOSS-UP

22) What is the integral of 2x dx?

ANSWER: x^2

# BONUS

22) What is the derivative of cos(5x)?

ANSWER: -5sin(5x)

**TOSS-UP**

23) If a group G under addition has three elements, e, h, and k, and e is the identity element, which of the following is true?

W) e + h = k

X) k + e = h

Y) h = k-1

Z) e + h + k = k

ANSWER: Z) e + h + k = k

# BONUS

23) What are the two different group tables that can be generated from groups of order 4?

W) Cyclic and Klein 4

X) Klein 4 and Z+

Y) Eigenvalue and Isomorphic

Z) Surjective and Bijective

ANSWER: Cyclic and Klein 4

# TOSS-UP

24) What is the mean of the terms in the following sequence: 5, 6, 8, 10, 11?

ANSWER: 8

# BONUS

24) What is the standard deviation of 5, 6, 8, 10, and 11?

ANSWER: sqrt 26

**TOSS-UP**

25) Find the vector-parametric equation of the line that passes through (3,5,8) and is parallel to 5j + 8k.

ANSWER: r = 3i + 5j + 8k + ƛ(5j + 8k)

# BONUS

25) What is the vector parallel to (x+8)/5 = (y-5)/0 = (z+8)/6

Answer: 5i + 6k