

Math Bee – Sample Packet (8th Grade)

Regulation Tossups

(1) [Computational Pyramidal] A triangle has a base length of 13 meters and a height of 6 meters. Given that the area of a triangle can be determined by multiplying one-half times the length of the base times the height, calculate the area of the triangle. You have five seconds to answer.

ANSWER: **39** square meters

(2) [Computational Non-Pyramidal] Objects V and W are moving in the same direction, and V is 84 meters in front of W. If V is moving at 9 meters per second, and W is moving at 13 meters per second, how many seconds will it take W to catch up to V? You have 30 seconds to answer.

ANSWER: **21** seconds

(3) [Computational Non-Pyramidal] If Malachi randomly chooses two distinct elements from the set {2, 3, 4, 7}, what is the SUM of the least possible and greatest possible products of those two elements? You have 30 seconds to answer.

ANSWER: **34**

(4) [Computational Non-Pyramidal] What is the area between y equals 4, y equals 8, x equals 0, and x equals 2? You have 30 seconds to answer.

ANSWER **8**

(5) [Computational Pyramidal] Casey can organize one-eighth of her room in a quarter of an hour. By setting up a direct ratio and solving for the numerator on one side, one can determine that, if she continues organizing at this rate, she can organize how much of her room in 1.75 hours? You have five seconds to answer.

ANSWER: **7 / 8** (or **seven-eighths**; accept **87.5%**)

(6) [Computational Non-Pyramidal] Events A and B are independent. If the probability of event B is 0.3, and the probability of event A given event B is 0.4, what is the probability of event A? You have 30 seconds to answer.

ANSWER: **0.4** (or **40%**; or **2/5**; or **two-fifths**)

(7) [Computational Non-Pyramidal] If 7 to the 7th power is divided by 8, what is the remainder? You have 30 seconds to answer.

ANSWER: **7**

(8) [Non-Computational Pyramidal] Johannes Kepler attempted to model planetary orbits using these figures in his *Mysterium Cosmographicum*. Euclid devoted the final book of the *Elements* to proving that there are exactly five of these figures. For the point, dodecahedra and cubes are examples of what highly symmetric polyhedra named for an ancient Greek philosopher? You have three seconds to answer.

ANSWER: **Platonic solids** (prompt on “Plato”)

(9) [Computational Pyramidal] A flag pole 18 feet tall casts a shadow 12 feet long at a specific time of day. By estimating the value of either the tangent or the sine of the angle formed by the flag pole and the shadow, find, to within 3 degrees either way and rounded to the nearest degree, the angle of elevation of the sun at that time of day. You have five seconds to answer.

ANSWER: **56** degrees (accept any answer from **53 to 59** degrees, inclusive)

(10) [Computational Non-Pyramidal] If $5x-12=8x-24$, what is the value of x ? You have 30 seconds to answer.

ANSWER: **4**

(11) [Non-Computational Pyramidal] This quantity appears on the right-hand side of Newton's second law when expressed as momentum over time. Instantaneous forms of this quantity are obtained via differential calculus, while average forms divide displacement by elapsed time. For the point, name this measure of how quickly an object's position changes. You have three seconds to answer.

ANSWER: **velocity**

(12) [Computational Non-Pyramidal] Evaluate this expression: $1+2+3+4+5+6+7+8+9+10$. You have 30 seconds to answer.

ANSWER: **55**

(13) [Computational Non-Pyramidal] Given that the secant of x is 4, and x is in the first quadrant, what is the sine of x ? You have 30 seconds to answer.

ANSWER: square **root of 15 over 4** (or square **root of fifteen-sixteenths**)

(14) [Computational Non-Pyramidal] What is the perimeter of an irregular pentagon with a base of 4 meters, two sides of 9 meters each, and two sides of 11 meters each? You have 30 seconds to answer.

ANSWER: **44** meters

(15) [Computational Pyramidal] Three answers required. The second angle, A_2 , of a triangle, is double the first, A_1 . The third angle, A_3 , is 40 degrees less than the first. By setting up a system of linear equations and knowing the value of the sum of the internal angles of a triangle, find the values of all 3 angles in degrees. You have five seconds to answer.

ANSWER: **$A_1 = 55$ degrees, $A_2 = 110$ degrees, $A_3 = 15$ degrees**

(16) [Non-Computational Pyramidal] Inferences named for this man can be used to estimate parameters within Hidden Markov Models. After this man's death, his friend Richard Price submitted his paper *An Essay towards Solving a Problem in the Doctrine of Chances* to the Royal Society. For the point, name this English Presbyterian minister and mathematician whose name is given to a theorem of conditional probabilistic reasoning. You have three seconds to answer.

ANSWER: Thomas **Bayes**

(17) [Computational Pyramidal] One can determine the probability of independent events occurring in a certain order by multiplying the probabilities of each individual event occurring. If a baseball team has a 60 percent chance of winning any given baseball game, and the result of any one game is independent of the others, what is the percentage chance that the team will win today's game and tomorrow's game, but lose the game two days from now? You have five seconds to answer.

ANSWER: **14.4%** ($0.6 \times 0.6 \times 0.4$)

(18) [Non-Computational Pyramidal] These entities are connected to even Mersenne primes via a formula proved by Euclid and later extended in one direction by Euler. Descartes and Fermat each attempted to find odd examples of these numbers, and though none have been discovered, it has also not been proven that they are all even. For the point, 6 and 28 are the first two examples of what integers that are the sum of their positive divisors? You have three seconds to answer.

ANSWER: **perfect** numbers

(19) [Computational Non-Pyramidal] There are 3 black marbles and 4 white marbles in a bag. If you choose a marble at random, what is the probability that it is black? You have 30 seconds to answer.

ANSWER: **$3/7$ (Three-Sevenths)**

(20) [Computational Non-Pyramidal] If the quantity open parenthesis x plus y close parenthesis cubed is expanded, what is the sum of the resulting expression's numerical coefficients? You have 30 seconds to answer.

ANSWER: **8**

(21) [Non-Computational Pyramidal] Viviani's Theorem states that for any point inside one of these figures, the sum of the perpendicular distances to its sides is constant. In complex geometry, regular hexagons, squares, and these figures compose tessellations. Each of these figures has angles measuring 60 degrees and exhibits rotational symmetry of order 3. For the point, name this type of triangle in which all three sides and all three angles are congruent. You have three seconds to answer.

ANSWER: **equilateral triangles** (prompt on "triangles")

(22) [Computational Non-Pyramidal] If a cube has a side length of 3, what is its volume? You have 30 seconds to answer.

ANSWER: **27**

(23) [Computational Non-Pyramidal] If $4x - 2 = 8$, what is the value of $6x$ squared plus 2? You have 30 seconds to answer.

ANSWER: **39.5** (or **39 and a half**)

(24) [Computational Non-Pyramidal] Given 1 red car, 2 blue cars, and 2 yellow cars, how many ways can you arrange the cars, assuming that color is the only differentiating factor? You have 30 seconds to answer.

ANSWER: **30**

(25) [Computational Non-Pyramidal] What is the sum of the two solutions to the equation x squared plus $4x$ minus 5 equals 0? You have 30 seconds to answer.

ANSWER: **-4 (negative four)** (solutions are $x = 1$ and $x = -5$)