2024 MTAP-NCR Math Contest
Elimination Round - Grade 9

Name _____ School _____

Division _____ Time Allotment: 120 minutes Score _____

For each of the following, write your final answer on the blank before each number.

_____ 1. Solve for x in $x(3x + 6) = 0$

_____ 2. What values of x *satisfy* the inequality $x^2 - x < 0$?

_____ 3. Is the graph of $(-2 + x)(x - 3) = 0$ facing upwards or downwards?

_____ 4. Simplify the following expression: $\sqrt[3]{x^7y^{-9}}$

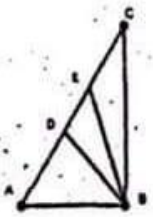
_____ 5. Simplify the following expression: $\frac{x^2x^{\frac{1}{2}}}{x^{-3/2}x^4}$.

_____ 6. Simplify the following expression: $12\sqrt{2} + 4\sqrt{3} - 2\sqrt{8} + \sqrt{27}$.

_____ 7. If y varies directly with x^3 and $y = 250$ when $x = 5$, then what is y when $x = 3$?

_____ 8. The perimeter of a rectangle is 24 cm and the length is 4 cm longer than the width. Find the area of the rectangle.

_____ 9. Triangle ABC is a right triangle. If BD is an angle bisector of $\angle ABC$ and BE is the angle bisector of $\angle DBC$, what is the measure of $\angle EBC$? (See figure)

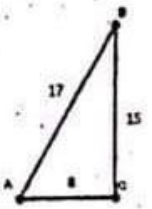


_____ 10. It is known that $\Delta ABC \sim \Delta DEF$ and $AB = 2DE$. What is the ratio of the area of ΔDEF to ΔABC?

_____ 11. Triangle ABC has sides 4, 6, 8 and triangle XYZ has sides 24, 18, 12. Which theorem or postulate allows us to conclude that the two are similar?

_____ 12. Find the value of $\sin 30° \times \tan 45° \times \cos 60°$

_____ 13. Find the value of $\cos A$ in the figure.



_____ 14. Solve for x: $(x - 3)(x + 2) = -2(x - 3)$.

_____ 15. Solve for x in the proportion: $\frac{5}{x-1} = \frac{3}{x-2}$.

_____ 16. How many integers satisfy the inequality $x^2 - x \leq 12$.

_____ 17. Solve for x: in $\frac{2x}{1-x} = \frac{5}{x+1}$.

_____ 18. Suppose that y varies jointly with x^2 and inversely with z, and $y = 96$ when $x = 8$ and $z = 4$. Find the value of y if $x = z = 2$.

_____ 19. The roots of the quadratic equation $y^2 + by + c = 0$ are 3 and -2. What is the value of $b + c$?

_____ 20. What is vertex of the parabola given by the equation $y = x^2 + 2x + 3$?

_____ 21. Simplify the following expression $\frac{(2x)^3y^{-4}}{(2y)^{-3}x^2}$.

_____ 22. Rationalize and simplify: $\frac{2+\sqrt{2}}{5-\sqrt{2}}$.

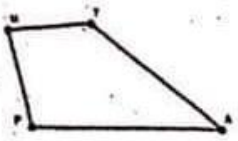
_____ 23. For which values of $x > 2$ do we have that the sum x and 5 times its reciprocal is greater than 5?

_____ 24. A meter stick casts a shadow of 4/3 meters. At the same time, how high is a building next to the stick if the shadow is as long as a basketball court (28 meters).

_____ 25. An isosceles trapezoid has bases of length 6 and 12. If the length of the legs is 5, what is the area of the trapezoid?

_____ 26. The diagonals of a rhombus have lengths 4 and 6. What is the perimeter of the rhombus?

_____ 27. Given that $MTAP$ is a kite, and $MT = x - 3$, $TA = y + 3$, $AP = 2x - 13$ and $PM = 3y - 15$, find the value of $x + y$. (See figure)



_____ 28. A rectangular garden requires 64 meters of fence. If the dimensions of the garden have a ratio of 3:1, find the area of the garden.

_____ 29. A man spotted an airplane with an angle of elevation of 30°. Suppose that he has information that the plane is 15 kilometers away. At what altitude is the plane?

_____ 30. The hypotenuse of triangle SUN is $SU = 60$ cm long. Find the lengths of the legs if $\sin \angle U = 4/5$.

_____ 31. Given triangle ABC with $AB = BC = 8$ and the included angle B has measure 30°, find the value of CA^2.

_____ 32. Find the equation of the parabola $y = ax^2 + bx + c$ whose vertex is at $(1,6)$ and a y-intercept of 10.

_____ 33. The sum of two numbers is $7/3$. The sum of their reciprocals is $7/2$. What is the product of the two numbers?

_____ 34. The area of a square will increase by 24 sq.m. if the length is increased by 2 m. What is the length of the original square?

_____ 35. The quadratic function $f(x) = 2x^2 + bx + c$ is such that the sum of its roots is -4 and the product of the roots is -3. Find $b + c$.

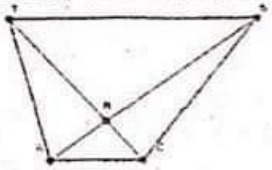
_____ 36. Solve for x: $\sqrt{100 - x} = 3\sqrt{x + 4}$

_____ 37. An egg is dropped from the top of a building 40 meters high. The height of the egg t seconds after it is released is given by $40 - 4.9t^4$ meters. How long will it take the egg to be broken on the sidewalk of the building?

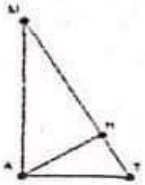
_____ 38. The point E lies on the diagonal AN of rectangle $JAUN$ such that EU is the altitude of ΔAUN. Find the length of EU if $JA = 20$ and $AU = 10$.

_____ 39. Jack and Jill have candies in the ratio of 5:6. After eating 5 candies each, the ratio becomes 4:5. How many candies does Jill have left?

_____ 40. In trapezoid $CATS$, $CR = 7$ and $RT = 9$. Find the value of CA if $TS = 22.5$. (See figure)



_____ 41. In the figure there are two right angles: $\angle MAT \cong \angle AHM$. If $AT = 15\ mm, TH = 9\ mm$, find the value of MA. (See figure)



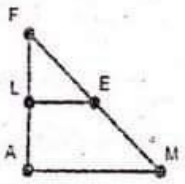
_____ 42. In right triangle ABC with $\angle B = 90°$, $\cos A = 2/7$. Find the value of $\cos C$.

_____ 43. What value of x and y will satisfy the following equality: $x^2 + y^2 = 4x - 6y - 14$?

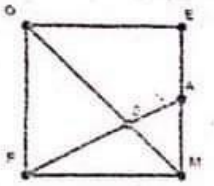
_____ 44. Find the values of b so that $2x^2 + bx + (1 - b) = 0$ has two real roots.

_____ 45. Arrange the following quantities in increasing order: $2^{-100}, 4^{-70}, 8^{-40}, 16^{-10}$.

_____ 46. In triangle FAM, points L, E are chose so that $MALE$ is a trapezoid. If $LA = 1$, and $MA = LE + 3$, what is the ratio FL/EL? (See figure)



_____ 47. The square $POEM$ is cut into four parts as shown. If A is the midpoint of EM and a side of the square is 10, find the length of AB. (See figure)



_____ 48. The angles of a triangle are in the ratio 2:3:4. Find the perimeter of the triangle is the shortest side has length 10.

_____ 49. The roots of the quadratic equation $2024x^2 + 10x - 5 = 0$ are r and s. Find the value of $\frac{1}{r} + \frac{1}{s}$.

_____ 50. Find the value of $\sqrt{a} - \sqrt{b}$ given that $\sqrt{a} + \sqrt{b} = 10 = 2\sqrt{ab}$.