2018 Metrobank-MTAP-DepEd Math Challenge
Elimination Round
Grade 9

Name: _____ **School:** _____ **Score:** _____

Instruction: Write your answer on the space provided before each item. Give all fractions and ratios in lowest terms. Figures are not drawn to scale.

_____ **1.** Find the value of k that will make $x^2 + 16x + k$ a perfect square.

_____ **2.** A number and its reciprocal have a sum of $\frac{34}{15}$. Find the smaller of these two numbers.

_____ **3.** Solve for x in $9x^2 - 10 = 6$.

_____ **4.** Solve for x in $(x^2 - 4)^2 - 2(x^2 - 4) = 15$.

_____ **5.** Solve the inequality $x^2 + 2x - 15 \geq 0$ for x.

_____ **6.** Let r and s be the roots of $x^2 + 10x - 7 = 0$. Find $rs + r + s$.

_____ **7.** Find the range of values of k so that $5x^2 + kx + 20 = 0$ has no real roots.

_____ **8.** Find the values of the constant n so that $4x^2 - 6(n+1)x + 9n + 4 = 0$ has 2 equal roots.

_____ **9.** One of the roots of $x^2 - bx + 48 = 0$ is three times the other, where $b > 0$. Find the b.

_____ **10.** Find the vertex of the graph of $y = x^2 - 4x + 5$.

_____ **11.** Find an equation of the parabola having its vertex at (-1, 3) and directrix at $y = 1$. Give the answer in the form $y = ax^2 + bx + c$.

_____ **12.** The graph of $y = x^2 + 5$ is shifted 3 units to the right and 4 units down. Find the corresponding quadratic function (in the form $y = ax^2 + bx + c$) for the resulting graph.

_____ **13.** A rectangular pen is to be constructed with one of its sides along a straight river bank. If 50 m of fencing will be used to enclose the three remaining sides, how long is the side parallel to the river, so that the pen has the largest possible area?

_____ **14.** Suppose that m varies inversely as n. If $m = 5$ when $n = 7$, find n when $m = \frac{35}{3}$.

_____ **15.** Suppose q varies directly as r and inversely as the cube of s. If $q = 5$ when $r = 1$ and $s = \frac{1}{2}$, find q when $r = 2$ and $s = 3$.

_____ **16.** Suppose m, n, and p are positive quantities such that m varies directly as n and n varies inversely as p. If m increases, will p increase or decrease?

_____ **17.** Rewrite with nonnegative exponents and simplify: $\dfrac{(x^3y^{-2})^2}{(x^{-2}y)^{-4}}$.

_____ **18.** Simplify: $\left(7^{\frac{1}{2}}3^{\frac{3}{4}}\right)^{\frac{4}{5}} 7^{\frac{3}{5}}3^{\frac{7}{5}}$.

_____ **19.** Rationalize the denominator and simplify: $\dfrac{4 + 3\sqrt{2}}{2 - 2\sqrt{2}}$.

_____ **20.** If $3 < x < 5$, simplify $\sqrt{x^2 - 10x - 25}$.

_____ **21.** Simplify: $\sqrt{32} + 5\sqrt{8} - 4\sqrt{18}$.

_____ **22.** Solve for x in: $5\sqrt{x} - 5 = 3\sqrt{x} + 7$.

_____ **23.** Solve for x in $\sqrt{2x + 7} = \sqrt{x} + 2$.

_____ **24.** If $q : r = 3 : 5$ and $r : t = 5 : 13$, find $t : q$.

_____ **25.** If $\dfrac{p - q}{3q} = \dfrac{5}{2}$, find $\dfrac{q}{p}$.

_____ **26.** Find all possible values of n in the proportion $(n - 5) : (n - 3) = (n + 3) : 20$.

_____**27.** An angle in a quadrilateral has measure 45°, while the others have degree measures in the ratio 5:7:9. Find the measure of the largest angle.

_____**28.** In rhombus $QRST$, $\angle RQS = 5\angle QRT$. Find $\angle RTS$.

_____**29.** The diagonals of the rhombus $PRAY$ intersect at G. If $AG = 3n$, $PG = 6$, $RG = 3m - 2n$, and $YG = m + 2n$, find the length (in units) of the shorter diagonal.

_____**30.** Find the perimeter (in units) of the rhombus $PRAY$ in the previous problem.

_____**31.** In parallelogram $ABCD$, $AB = 8$, $BC = 5$, $CD = 7x - 2y$, and $AD = x + y$. Find x.

_____**32.** In parallelogram $LMNO$, $\angle M = (2x + 10)°$, $\angle N = (5x - 5)°$. Find x.

_____**33.** In an isosceles trapezoid, the lengths of the diagonals are $2x + 3$ and $6x - 5$. Find x.

_____**34.** The diagonals of quadrilateral $ABCD$ are perpendicular and they intersect at E. If $BE = DE = 4$, AC is twice as long as EC, and the area of the quadrilateral is 24 sq. units. Find the length (in units) of AE.

_____**35.** The sides of $\triangle MNO$ are 5 cm, 7 cm, and 10 cm. If $\triangle MNO \sim \triangle PQR$, find the length of the shortest side of $\triangle PQR$ if its longest side is 15 cm.

_____**36.** The ratio of the lengths of corresponding sides of two similar triangles is 3:4. Find the ratio of their areas.

_____**37.** Given the points $P(0,0)$, $Q(12,0)$, $R(24,0)$ and $S(6,6)$ on the plane, the point T is chosen so that $PS \parallel QT$ and $QS \parallel RT$. Find the coordinates of T.

_____**38.** Two sides of a rectangle are 10 cm and 24 cm. Find the length of a diagonal.

_____**39.** The two legs of a right triangle are in the ratio $\frac{\sqrt{3}}{2}$. If the hypotenuse is 10 units long, find the area (in square units) of the triangle.

_____**40.** In $\triangle ABC$, $\angle C = 90°$ and $\sin A = \frac{5}{13}$. Find $\sin B$.

(For Problems 41-43) In $\triangle ABC$, $\angle C = 90°$. Let D be a point on AB so that $CD \perp AB$.

_____**41.** Suppose $AD = 9$ and $BD = 4$. Find CD in units.

_____**42.** Suppose $AD = 20$ and $BD = 5$. Find BC in units.

_____**43.** Suppose $AC = 24$ and $\frac{AD}{BD} = 4$. Find BC in units.

_____**44.** A ladder is leaning against a vertical wall which is 5 m high. The top of the ladder slides all the way down the wall so that the bottom of the ladder slides 1 meter away from its original position. How long is the ladder?

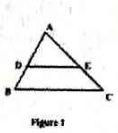

Figure 1

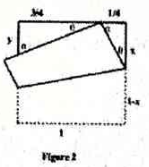

Figure 2

(For Problems 45-47) In $\triangle ABC$, points D and E are on AB and AC, resp., so that $DE \parallel BC$. See Figure 1.

_____**45.** Suppose $DE = 2$, $BC = 8$, and $AE = 4$. Find AC.

_____**46.** Suppose $DE = 3$, $BC = 5$, and the perimeter of $\triangle ABC$ is 25. Find the perimeter of $\triangle ADE$.

_____**47.** Suppose $AD = 3$, $DB = 9$, $AE = x - 4$, and $EC = x$. Find x.

_____**48.** Using Figure 2 above, find the value of x.

_____**49.** Using Figure 2, find the value of y.

_____**50.** Using Figure 2, find the value of $\tan \alpha$.

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Answer Key

1. $k = 64$
2. $\frac{3}{5}$
3. $x = \frac{4}{3}$ or $x = -\frac{4}{3}$
4. $x = \pm 1$, $x = \pm 3$
5. $x \leq -5$ or $x \geq 3$
6. -17
7. $-20 < k < 20$
8. $n = \frac{7}{3}, -\frac{1}{3}$
9. $b = 16$
10. V(2,1)
11. $y = 8x^2 - 16x + 1$
12. $y = x^2 + 6x + 18$
13. 25 m
14. $m = 21$
15. $q = \frac{5}{108}$
16. p will decrease
17. $\frac{1}{x^2}$
18. 63
19. $\frac{-10 - 7\sqrt{2}}{2}$ or $-5 - \frac{7\sqrt{2}}{2}$
20. $5 - x$
21. $2\sqrt{2}$
22. $x = 36$
23. $x = 1$ or 9
24. 13:3
25. $\frac{q}{p} = \frac{2}{17}$
26. $n = 7, 13$
27. 135°
28. 15°
29. 12
30. 40
31. $x = 2$
32. $x = 25°$
36. 9:16
37. (18, 6)
38. 26
39. $\frac{100\sqrt{3}}{7}$
40. $\frac{12}{13}$
41. 6
42. $5\sqrt{5}$
43. $\frac{24\sqrt{5}}{5}$
44. 13 m
45. $AC = 20$
46. 15 units
47. $x = 6$
48. $\frac{15}{32}$
49. $\frac{2}{5}$
50. $\frac{15}{8}$