



UNIVERSITY OF EDUCATION, WINNEBA
SUBJECT AREA TEST (SAT)
MATURE ENTRANCE EXAMINATION, NOV. 2024
BSC MATHEMATICS EDUCATION
MATURE ENTRANCE EXAMINATIONS

INDEX NUMBER: TIME ALLOWED: 2HOURS

**Instruction: ANSWER ALL QUESTIONS: PLEASE SHADE WITH PENCIL THE
 CORRECT ANSWERS ON THE MCQ SHEETS PROVIDED**

1. Evaluate $3\sqrt{5} \left(\frac{3}{\sqrt{5}} + \sqrt{5} \right)$.

- a. 31
- b. 24
- c. $12\sqrt{5}$
- d. $9\sqrt{5}$

2. Simplify:

$$(3x - y)(3x + y) - (3x + 2y)(3x - 2y).$$

- a. y
- b. $2y$
- c. y^2
- d. $3y^2$

3. Expand $(x - \sqrt{2})(x + \sqrt{2})$.

- a. $x^2 - 2\sqrt{2} - 2$
- b. $x^2 + 2\sqrt{2} - 2$
- c. $x^2 - \sqrt{2}$
- d. $x^2 - 2$

4. The coordinate of the points P and Q are $(4, 3)$ and $(2, -1)$ respectively. Find the shortest distance between P and Q .

- a. $10\sqrt{2}$
- b. $4\sqrt{5}$
- c. $5\sqrt{2}$
- d. $2\sqrt{5}$

5. If $x = 2$, $y = -3$ and $z = -4$, evaluate $(y - x)(x - z)(z - y)$.

- a. 210
- b. 30
- c. -30
- d. -210

6. Factorize the expression $9x^2t^2 - 1$.

- a. $(3xt - 1)^2$
- b. $(3xt + 1)(3x - 1)$
- c. $(3xt + 1)(3xt - 1)$
- d. $(3x + 1)(3xt - 1)$

7. For what value of x is the function $f(x) = \frac{x}{3x-2}$

undefined?

- a. $\frac{3}{2}$
- b. $\frac{2}{3}$
- c. $\frac{-2}{3}$
- d. $\frac{-3}{2}$

8. A discount of *GHC* 480.00 was given on an article marked *GHC* 24,000.00. What was the percentage discount?

- a. 10%
- b. 5%
- c. 4%
- d. 2%

9. Kofi, Ette and Ali shared 120 oranges in the ratio 2:3:5. By how much is the **least** share less than the **greatest**?

- a. 24
- b. 30
- c. 36
- d. 60

10. If $\frac{1}{R} = \frac{1}{6} + \frac{1}{9}$, find the value of R .

- a. 0.278
- b. 1.800
- c. 3.600

d. 7.500

11. If $(x - 3)$ and $(2x + 3)$ are factors of

$2x^2 + mx + n$, find the value of $(m + n)$.

- a. -18
- b. -15
- c. -12
- d. -6

12. If $\sin(2x - 12)^\circ = \frac{1}{2}$ and $0^\circ \leq x \leq 90^\circ$, find x .

- a. 9°
- b. 12°
- c. 21°
- d. 30°

13. The exterior angles of a polygon are $2x^\circ$, $(x - 20)^\circ$, x° , $(3x + 10)^\circ$, $(x + 15)^\circ$ and $(2x + 5)^\circ$. Find the value of x .

- a. 31°
- b. 35°
- c. 37°
- d. 41°

14. A solid cone has base radius 7 cm. If the volume of the cone is 1078 cm^3 , find the vertical height of the cone. [Take $\pi = \frac{22}{7}$]

- a. 7 cm
- b. 21 cm
- c. 22 cm

d. 154 cm

15. A chord is 6 cm from the centre of a circle with radius 10 cm. Calculate its length.

a. 4 cm

b. 16 cm

c. 32 cm

d. 64 cm

16. Make t the subject of the relation: $r = \sqrt{\frac{t-3}{9-t}}$.

a. $t = \frac{r^2 + 3}{1 + r^2}$

b. $t = \frac{9r^2 + 3}{1 + r^2}$

c. $t = \frac{3r^2 + 1}{1 + r^2}$

d. $t = \frac{3r^2}{1 + r^2}$

Sets X , Y and Z are represented in the Venn diagram.

Use the diagram to answer questions 17 and 18

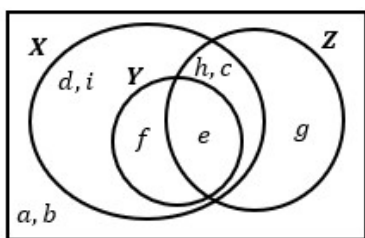
17. Find $X \cap Y \cap Z$.

a. $\{e\}$

b. $\{h, c\}$

c. $\{e, h, c\}$

d. $\{e, f, h, c\}$



18. Find $n(Y' \cap Z)$.

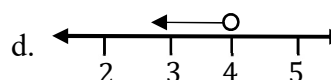
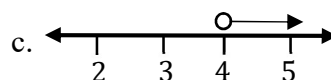
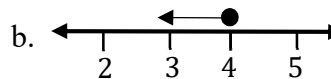
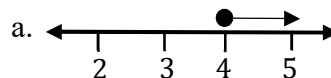
a. 1

b. 2

c. 3

d. 4

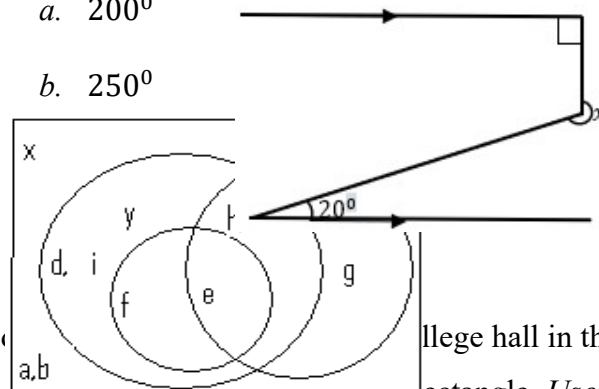
19. Which of the following number lines represents the solution to the inequality $6x + 1 \geq 8x - 7$?



20. Find the value of x in the figure.

a. 200°

b. 250°



The shape of a semi-circle mounted on a rectangle. Use it to answer questions 21 and 22.

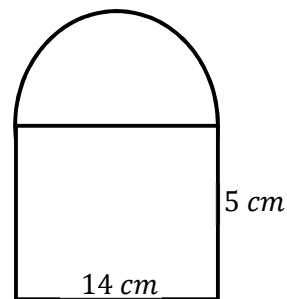
21. Calculate the area of the window.

a. 224 cm^2

b. 147 cm^2

c. 112 cm^2

d. 92 cm^2



22. Calculate the perimeter of the window.

a. 174 cm

b. 60 cm

c. 46 cm

d. 41 cm

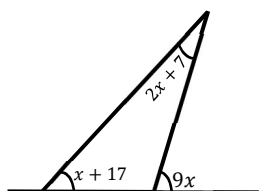
23. Find the value of $9x$ in the diagram.

a. 18°

b. 36°

c. 54°

d. 60°



24. A number is chosen at random from the set $X = \{1, 2, 3, \dots, 10\}$. What is the probability that the number chosen is **either** a factor of 24 **or** a multiple of 5?

a. $\frac{4}{5}$

b. $\frac{3}{5}$

c. $\frac{2}{5}$

d. $\frac{1}{5}$

In the diagram, O is the centre of the circle, YT is a tangent, $\angle TYZ = 20^\circ$ and $XO \parallel YZ$. Use the information to answer questions 25 and 26.

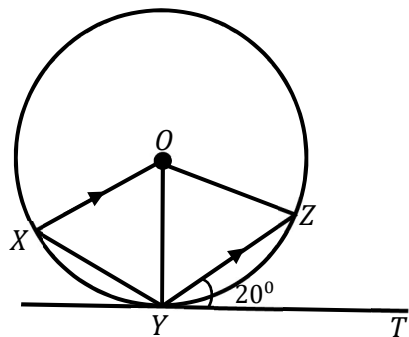
25. Find $\angle XOY$.

a. 40°

b. 60°

c. 70°

d. 80°



26. Calculate the value of the reflex angle XOZ .

a. 220°

b. 225°

c. 230°

d. 250°

27. Given that p varies inversely as the square of q .

Find q when $p = \frac{1}{4}$.

a. 16

b. 8

c. 4

d. 2

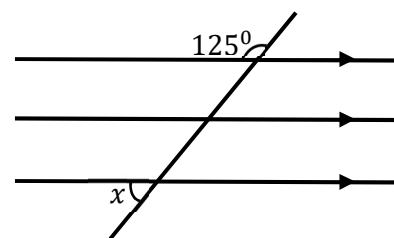
28. A straight line intersects three parallel lines as shown in the diagram. Find the value of x .

a. 35°

b. 55°

c. 65°

d. 125°



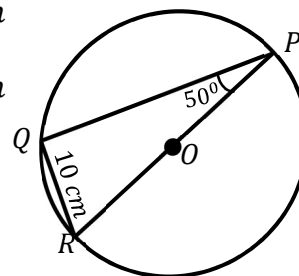
29. In the diagram, O is the centre of the circle, $\angle QPR = 50^\circ$ and $|QR| = 10$ cm, calculate, correct to one decimal place, radius of the circle.

a. 15.6 cm

b. 13.0 cm

c. 7.8 cm

d. 6.5 cm



30. Which of the following is true about a rhombus?

I. The diagonals are equal

II. The diagonals meet at right angles

III. Each diagonal bisects the area of the rhombus

a. I and II only

- b. I and III only
- c. II and III only
- d. I, II and III

31. In the diagram, PQRS is a parallelogram. If $\angle QPS = 2x$, $\angle RSP = 3x$ and $\angle RST = y$, find the value of y .

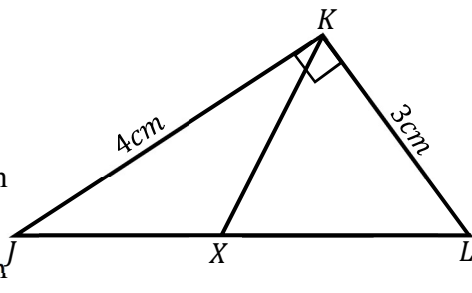
- a. 108°
- b. 72°
- c. 60°
- d. 36°

32. Simplify $\frac{\log 27}{\log 6 - \log 2}$.

- a. 3
- b. $\log 3$
- c. $\frac{\log 3}{\log 2}$
- d. $\frac{3}{\log 2}$

33. JKL is a triangle and KX bisects $\angle JKL$. If $|JK| = 4$ cm, $|KL| = 3$ cm and $\angle JKL = 90^\circ$, find $|JX|$.

- a. 5 cm
- b. 3 cm
- c. $2\frac{6}{7}$ cm
- d. $2\frac{1}{7}$ cm

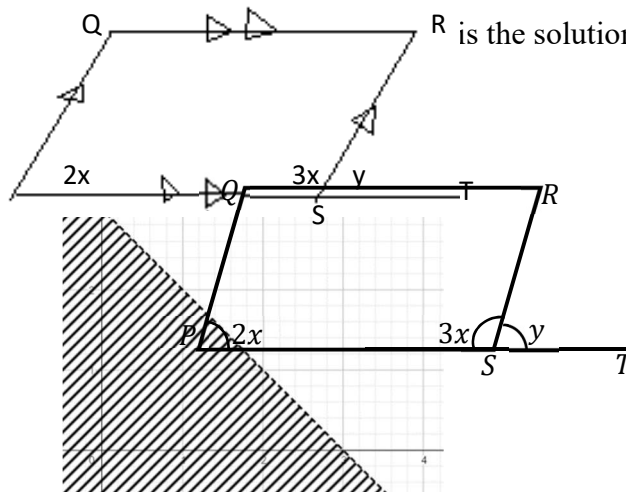


34. The height and volume of a cylinder are 21 cm and 594 cm^3 respectively. Calculate the diameter of its base. [Take $\pi = \frac{22}{7}$].

- a. 3 cm

- b. 6 cm
- c. 9 cm
- d. 12 cm

35. R is the solution



- a. $x + y < 3$
- b. $x + y \leq 3$
- c. $x + y > 3$
- d. $x + y \geq 3$

36. The table shows the frequency of the sizes of shoes produced by a factory. Calculate correct to the nearest whole number, the mean size of the shoes.

- a. 6
- b. 7
- c. 8
- d. 9

Size	5	6	7	8	9	10	11
Freq.	4	6	9	15	14	7	5

37. Solve $\left(\frac{1}{125}\right)^x - \left(\frac{1}{25}\right)^{\frac{3}{4}} = 0$.

- a. 2
- b. $1\frac{1}{2}$

c. $\frac{3}{4}$

d. $\frac{1}{2}$

38. Solve these equations simultaneously:

$$3x + 5y + 6 = 0, 2x = 3y + 15.$$

a. $x = 3, y = 3$

b. $x = 3, y = -3$

c. $x = -3, y = 3$

d. $x = -3, y = -3$

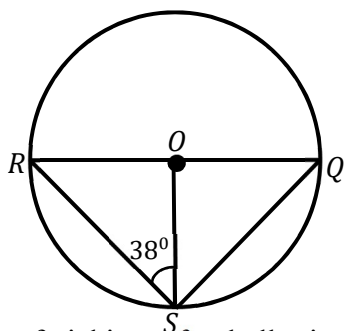
39. In the diagram, O is the centre of the circle, RQ is a straight line and $\angle OSR = 38^\circ$. Find the value of $\angle OSR + \angle ORS + \angle SOQ$.

a. 76°

b. 114°

c. 144°

d. 152°



40. The probability of picking a footballer in a group of 120 sportsmen is $\frac{5}{8}$. How many sportsmen were not footballers?

a. 8

b. 45

c. 60

d. 75

41. A ship sails from a port O on a bearing of 315° to a point P . If P is 8 km west of O , calculate $|OP|$.

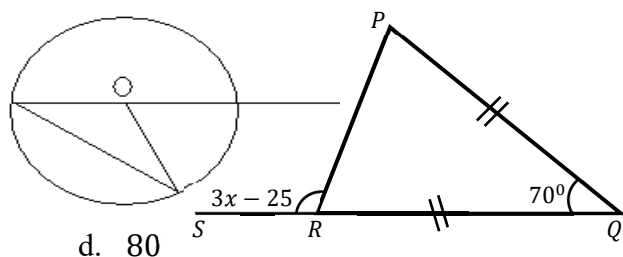
a. 5.66 km

b. 8.00 km

c. 10.00 km

d. 11.31 km

42. Find the value of x in the diagram above.



d. 80

43. If $\{p, q\}$ is the truth set of the equation $x^2 + 10x = 96$, evaluate $(p + q)$.

a. -96

b. -22

c. -10

d. 22

44. Write 2.32472 correct to three decimal places.

a. 2.320

b. 2.324

c. 2.325

d. 2.327

45. Awa is m years old now old Fatou is y years

older than Awa. If $(x - 5)$ years ago, Fatou was twice as old as Awa, express x in terms of y and m .

a. $x = m + y + 10$

b. $x = m + 2y - 5$

c. $x = m - y + 5$

d. $x = m + 2y + 5$

46. The dimensions of a cuboid are 5 cm by 4 cm by 6 cm. Calculate its total surface area.

a. 188 cm^2

b. 148 cm^2

c. 120 cm^2

d. 74 cm^2

47. Solve the equation: $2^{9x-3} = 8^{3-x}$.

a. $x = 3$

b. $x = 2$

c. $x = 1$

d. $x = 0$

48. Find the smaller value of x which satisfies the

equation: $x \left(x + \frac{6}{x} - 1 \right) = 12$.

a. 3

b. 2

c. -2

d. -3

49. If $4m_{\text{five}} = 114_{\text{ten}}$, what is the value of m ?

a. 4

b. 3

c. 2

d. 1

50. Simplify: $\frac{3}{4} \sqrt{128} - \sqrt{32} - \frac{1}{5} \sqrt{50}$.

a. $2\sqrt{2}$

b. $\sqrt{2}$

c. $-\sqrt{2}$

d. $-2\sqrt{2}$

51. Solve for the expression $4(x + 1) + (2x + 1)$.

a. $7x + 5$

b. $6x + 5$

c. $8x - 6$

d. $8x + 6$

52. Factorize completely $3a^2 + 2ab - 12ac - 8bc$.

a. $(3a + 2b)(a - 4c)$

b. $(3a - b)(2a - 4c)$

c. $(3a - 2b)(2a - c)$

d. $(3a - 2b)(a + 4c)$

53. Make t the subject of the relation $v = u + at$.

a. $t = \frac{v-u}{a}$

b. $t = \frac{v+u}{a}$

c. $t = \frac{uv-a}{c}$

d. $t = \frac{au-v}{a}$

54. Find the truth set of $x - 2 + 3(3x - 1) -$

$$4(x + 3) = 3.$$

A. $\left\{x: x = \frac{9}{10}\right\}$

B. $\left\{x: x = \frac{10}{3}\right\}$

C. $\left\{x: x = \frac{3}{10}\right\}$

D. $\left\{x: x = \frac{10}{7}\right\}$

55. Factorize completely the expression $2x^2 - 3x +$

1.

a. $(x - 2)(2x - 1)$

b. $(x - 1)(2x - 1)$

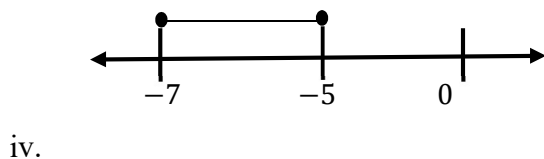
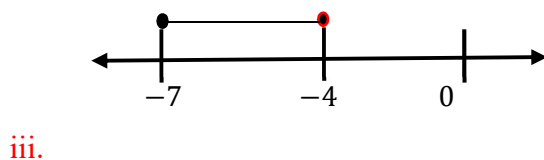
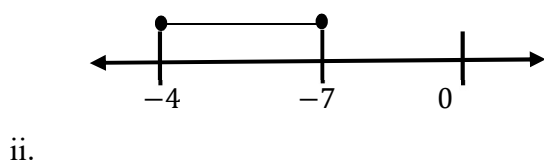
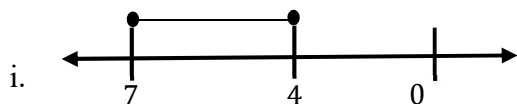
c. $(x - 1)(x - 2)$

d. $(x + 1)(2x + 1)$

56. Solve $2x - 5(4 - x) \leq 1$.

- a. $x \geq 3$
- b. $x \leq 5$
- c. $x \geq 6$
- d. $x \leq 3$

57. Represent this truth set $\{-7 \leq y \leq -4\}$ on a number line



58. Solve simultaneously $x + y = 2$ and $3x - 2y = 1$

- a. $x = 1, y = 1$
- b. $x = -1, y = 1$
- c. $x = -1, y = -1$
- d. $x = \frac{1}{2}, y = 1$

59. Simplify $\frac{1}{3} \left(\frac{2\frac{1}{6} + 5\frac{1}{6}}{1\frac{7}{12}} \right)$

- i. $1\frac{31}{57}$
- ii. $3\frac{21}{57}$
- iii. $7\frac{1}{57}$
- iv. $7\frac{7}{57}$

60. Write 1.02616 correct to 3 significant figures.

- a. 1.02
- b. 1.03
- c. 1.026
- d. 1.0262

61. Given that $\theta = 60^\circ$ and $\beta = 30^\circ$, evaluate

$$\frac{\sin \beta + 2 \cos \theta}{\cos \beta}.$$

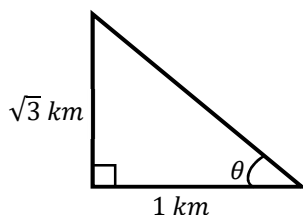
- a. $3\sqrt{3}$
- b. $1 + 2\sqrt{3}$
- c. $\sqrt{3}$
- d. $1 - \sqrt{3}$

62. If $\sin(2x - 12)^\circ = \frac{1}{2}$, and $0^\circ \leq x \leq 90^\circ$, find x .

- i. 9°
- ii. 12°
- iii. 21°
- iv. 30°

63. Work out the size of the angle marked θ .

- a. 30°
- b. 45°
- c. 60°
- d. 90°



64. If $\sin \theta = \frac{3}{5}$, find the value of $2 \sin \theta + 3 \cos \theta$.

- a. 3
- b. $3\frac{1}{5}$
- c. $3\frac{2}{5}$
- d. $3\frac{3}{5}$

65. Joe stands at the top of a cliff and looks down at a 49° angle of depression at a boulder that is 17m away from the bottom of the cliff. How tall is the cliff?

- i. 25.9 m
- ii. 19.6 m
- iii. 12.8 m
- iv. 11.2 m

66. Given that $\cos x = \frac{12}{13}$, evaluate $\frac{1 - \tan x}{\tan x}$.

- b. $\frac{5}{13}$
- c. $\frac{5}{7}$
- d. $\frac{7}{5}$
- e. $\frac{13}{5}$

67. An angle in standard position whose measure is -30° has its terminal side in

- A. Quadrant I
- B. Quadrant II
- C. Quadrant III
- D. Quadrant IV

68. What is the measure in degrees of the angle $A =$

$$\frac{7\pi}{6}?$$

- A. 210°
- B. 150°
- C. 120°
- D. 100°

69. If $0 < a < \pi$ and $\cos a = -\frac{\sqrt{3}}{2}$, then $a = ?$

- A. $-\frac{\pi}{6}$
- B. $\frac{\pi}{6}$
- C. $\frac{5\pi}{6}$
- D. $\frac{4\pi}{3}$

70. Simplify the identity: $\frac{1}{1+\sin x} + \frac{1}{1-\sin x}$.

- a. $\sec^2 x$
- b. $2 \sec^2 x$
- c. $\csc^2 x$
- d. $2 \csc^2 x$

71. Distance between points $(2, 5)$ and $(7, -3)$ is

- A. 6.43 units
- B. 9.43 units
- C. 12.43 units
- D. 15.43 units

72. Determine the point of intersection of the lines

$$2x - 3y = 8 \text{ and } 3x + 4y + 5 = 0.$$

- a. $(-1, 2)$
- b. $(-2, -2)$
- c. $(1, -2)$
- d. $(1, 2)$

73. Find the equation of the line passing through the point $B(-2, -6)$ and $C(5, -4)$.

- a. $2x - 7y - 38 = 0$
- b. $2x + 7y + 38 = 0$
- c. $7y - 2x - 38 = 0$
- d. $2x - 7y = -38$

74. A circle is centered at $(2, -7)$ and has a radius of 5 cm. What is the equation of the circle?

A. $2x^2 + 2y^2 + 4x - 14y + 28 = 0$

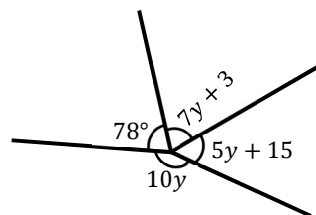
B. $x^2 + 2y^2 - 4x + 14y + 28 = 0$

C. $x^2 + y^2 - 4x + 14y - 28 = 0$

D. $x^2 + y^2 - 4x + 14y + 28 = 0$

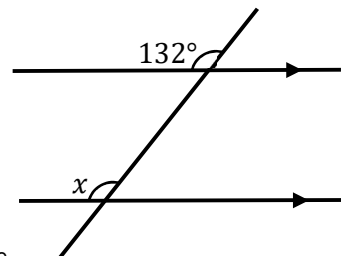
75. Find the value of y in the diagram.

- a. 10°
- b. 12°
- c. 14°
- d. 18°



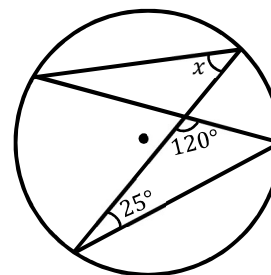
76. Find the measure of the angle marked x .

- a. 24°
- b. 48°
- c. 64°
- d. 132°



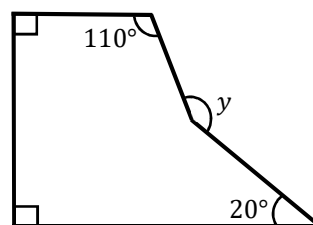
77. Find the value of x in the diagram below.

- a. 60°
- b. 35°
- c. 30°
- d. 25°

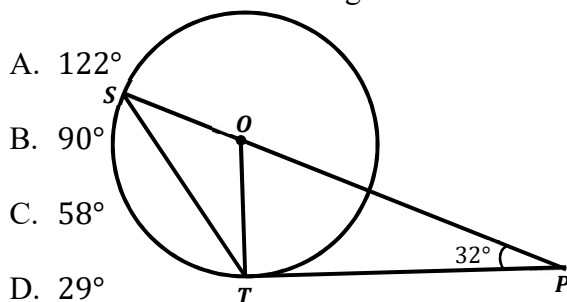


78. Find the measure of the angle marked y .

- A. 130°
- B. 140°
- C. 160°
- D. 230°



79. Find the value of $\angle STO$ in the diagram below.



80. A circle is given by the equation $2x^2 - 6x + ky^2 +$

$y = 9$, find the value of the constant k .

- a. 2
- b. 1
- c. -2
- d. -6

81. Without using calculator, evaluate

$$16.5 \times 6.67 - 4.67 \times 16.5$$

- A. 25
- B. 30
- C. 33
- D. 35

82. Factorize completely $3p^2 + 2tq + 6qp + pt$

- A. $(3p + t)(p + 2q)$
- B. $(3p + pt)(p + 2q)$
- C. $(3p + t)(p + q)$
- D. $(p + t)(p + 2q)$

83. Find the solution set of $n - \frac{2}{3} > \frac{1}{3} - n$

- A. $\{n: n > \frac{1}{2}\}$
- B. $\{n: n < \frac{1}{2}\}$
- C. $\{n: n > \frac{1}{3}\}$
- D. $\{n: n < \frac{1}{3}\}$

84. One-fourth of a number x added to one-fifth of the same number is less than or equal to 18. Find the range of values of the number.

- A. $x \leq 20$
- B. $x \geq 20$
- C. $x \leq 40$
- D. $x \geq 40$

Use this information to answer question 5 and 6.

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

85. Make u the subject of the relation

- A. $u = \frac{f}{v-f}$
- B. $u = \frac{fv}{v+f}$
- C. $u = \frac{f}{v+f}$
- D. $u = \frac{fv}{v-f}$

86. Find the value of u when $f = 6$ and $v = 3$

- A. 6
- B. -6
- C. 6
- D. -8

87. What property of set is shown by

$$P \cap (Q \cup R) = (P \cap Q) \cup (P \cap R)$$

- A. Commutative
- B. Associative
- C. Distributive
- D. Closure

88. If set B is a subset of A , then

- A. Sets A and B have the same number of elements.
- B. Some members of set B can be found in set A
- C. No member of set B is in set A
- D. All the members of set B are in set A

89. Evaluate $3\sqrt{7}(7 - 2\sqrt{7})$ if $\sqrt{7} = 2.646$

- A. 15.566
- B. 14.5
- C. 13.98
- D. 13.566

90. Simplify $\sqrt{5}\left(\sqrt{5} + \frac{3}{2\sqrt{5}}\right)$

- A. $6\frac{2}{3}$
- B. $6\frac{1}{2}$
- C. $5\frac{2}{3}$
- D. $5\frac{1}{2}$

91. Convert 342_{eight} to number base 10.

- A. 226
- B. 228
- C. 230
- D. 233

92. If $123_x = 102_6$, find the value of x .

- A. 2
- B. 3
- C. 4
- D. 5

93. Given that $x * y = 2x - y$, where x and y are real numbers, find the value of $5 * (4 * 5)$

- A. 7
- B. 8
- C. 12
- D. 9

94. If $24 = 3 \bmod x$, find the value of x

- A. 21
- B. 18
- C. 12
- D. 6

95. A function is defined by $f: x \rightarrow \frac{2+x}{1+x}$ find the image of 1 under f .

- A. $\frac{2}{3}$
- B. $\frac{3}{2}$
- C. $\frac{3}{5}$
- D. $\frac{3}{4}$

96. r varies directly as the cube root of v . When $r = 5$, $v = 125$, find the value of r when $v = 8$

- A. 1
- B. 2
- C. 3
- D. 4

97. P is inversely proportional to Q^2 . If $Q = 5$ when $P =$

2. Find the positive value of Q when $P = \frac{1}{2}$

- A. 100
- B. 50
- C. 25
- D. 10

98. Find the zeros of $f(x) = x^2 - x - 2$

- 1. 2 and -1
- 2. 2 and 1
- 3. -2 and -1
- 4. -2 and 1

In the diagram below, $|PS| = 20\text{cm}$, $|QR| = x\text{cm}$,
 $\angle SPR = 60^\circ$ and $\angle SRP = 90^\circ$.

Use the diagram to answer question 99 and 100

99. Find x

71. 4

72. 6

73. 10

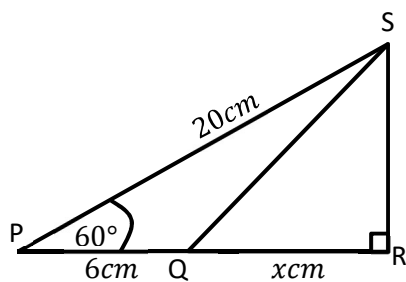
74. 11.32

100. Calculate $|SR|$

71. 22.4 cm

72. 19.6 cm

73. 19.1 cm



74. 17.3 cm