# Grade 10 Andhra Pradesh Maths 2016 Paper - I

**SECTION - I**

**GROUP – A**

Q1. Expand $\log \frac{343}{125}$

**Solution:**

Logarithmic rules:

i) $\log\left(\frac{x}{y}\right) = \log x - \log y$

ii) $\log a^n = \text{n}\log a$

$\log\left(\frac{343}{125}\right)$

$= \log\left(\frac{7^3}{5^3}\right)$

$= \log\left(\frac{7}{5}\right)^3$

$= 3\log\left(\frac{7}{5}\right)$

$= 3[\log 7 - \log 5]$

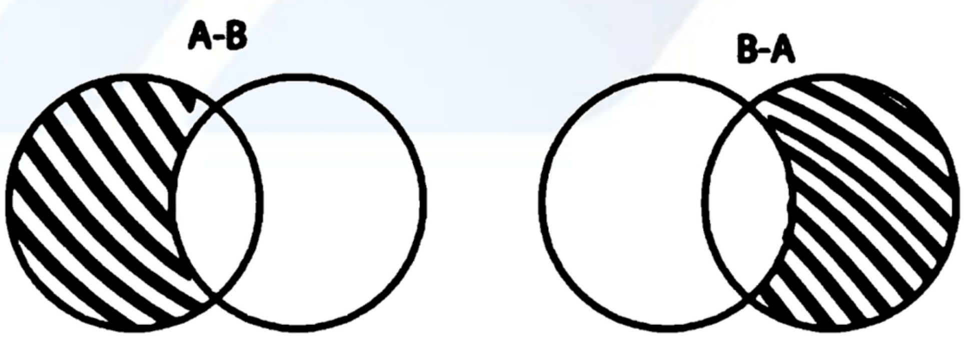
$= 3\log 7 - 3\log 5$

$= \frac{3\log 7}{3\log 5}$

$= \frac{\log 7}{\log 5}$

Q2. Draw the Venn diagrams of the sets $(\text{A} - \text{B}), (\text{B} - \text{A})$.

**Solution:**




Q3. Find a quadratic polynomial, if the zeroes of it are 2 and -1 respectively.

**Solution:**

Quadratic polynomials $= x^2 - ($ sum of the zeroes $)x +$ product of zeroes $= 0$

Sum of the zeroes $= 2 + (-1) = 1$

Product of the zeroes $= 2 \times -1 = -2$

$x^2 - x - 2 = 0$ is the quadratic polynomial.

Q4. Find the roots of equation $2x^2 + x - 6 = 0$ by factorisation.

**Solution:**

Given the quadratic equation: $2x^2 + x - 6 = 0$

Splitting the middle term,

$2x^2 + 4x - 3x - 6 = 0$

$2x(x + 2) - 3(x + 2) = 0$

$(x + 2)(2x - 3) = 0$

Therefore,

$x + 2 = 0$ or $2x - 3 = 0$

$x = -2$ or $x = \frac{3}{2}$

**GROUP - B**

Q5. 10 students of class $X$ took part in a mathematics quiz. If the number of girls is four more than the number of boys; then find the number of boys and the number of girls, who took part in the quiz.

**Solution:**

Let the number of boys be $x$.

The number of girls is $10 - x$.

The number of girls $= 4 +$ number of boys

$10 - x = 4 + x$

$6 = 2x$

$x = 3$

Number of boys $= 3$

Number of girls = 7

Q6. Find the number of terms in the following AP. $7, 13, 19, \ldots\ldots., 205$

**Solution:**

A.P. 7,13,19, … … ,205

$a = 7$

$d = 13 - 7 = 6$

$A_n = 205$

$A_n = a + (n-1)d$

$205 = 7 + (n-1)6$

$205 - 7 = (n-1)6$

$198 = (n-1)6$

$n - 1 = \frac{198}{6}$

$n - 1 = 33$

$n = 33 + 1$

$n = 34$

Thus, the total number of terms is 34.

Q7. Find the coordinates of the point, which divides the join of $(-1, 7)$ and $(4, -3)$ in the ratio $2:3$.

**Solution:**

$m:n = 2:3$

$(x, y) = \frac{(mx_2 + nx_1)}{m+n}, \frac{(my_2 + ny_1)}{m+n}$

$= \frac{2 \times 4 + 3 \times [-1]}{[2+3]}, \frac{2 \times [-3] + 7 \times 3}{[2+3]}$

$= \left(\frac{5}{5}\right), \frac{-6+21}{5}$

$= 1, 3$

Q8. Find the area of the triangle, whose vertices are $(2, 0), (1,2), (-1, 6)$. What do you observe?

**Solution:**

Area of the triangle $= |2(2-6) - 0(1+1) + 1(6+2)|$

$= |(-8) + 0 + 8|$

$= 0$

If the area of triangle $= 0$, then the three points are collinear.

**SECTION - II**

Q9. Find the value of $\log_{81} 3$.

**Solution:**

$\log_{81} 3 = x$

Rewrite as an exponential. In this case, $x$ is the exponent, and 81 is the base.

$81^x = 3$

Find a common base for both sides, which is 3 .

$81=3^4$

$(3^4)x=3$

Use the exponent rule $(x^a)^b=x^{ab}$

$3^{4x}=3^1$

$4x=1$

$x=\frac{1}{4}$

Q10. List all the subsets of the following set $B=\{p,q\}$.

**Solution:**

All subsets of B are }, $\{p\},\{q\},\{p,q\}$.

Q11. Write the following set $\{x: x=2n+1 \text{ and } n\in N\}$ in roster form.

**Solution :**

$\{3,5,7,9,11,13,\ldots\ldots\}$

Q12. If $p(x)=x^2-5x-6$, then find the value of $p(3)$ .

**Solution :**

$p(x)=x^2-5x-6$

$p(3)=3^2-3\times 5-6$

$=9-15-6$

$=-12$

Q13. Find the common ratio of GP $2, 2\sqrt{2}, 4, \cdots\cdots\cdots$

**Solution :**

$r=\frac{2\sqrt{2}}{2}$

$=\sqrt{2}$

So, the common ratio is $\sqrt{2}$.

Q14. Find the midpoint of the line segment joining the points (2, 7) and (12, −7) .

**Solution :**

Given points are

$(2,7)=(x_1,y_1)$

$(12,-7)=(x_2,y_2)$

mid point $=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$

$\Rightarrow \frac{(2+12)}{2}, \frac{7+-7}{2}$

$\Rightarrow \left(\frac{14}{2}, \frac{0}{2}\right)$

$(7, 0)$ is the midpoint.

## GROUP - A

Q15. Show that $5-\sqrt{3}$ is irrational.

**Solution:**

Assume that $5-\sqrt{3}$ is a rational number such that $a, b$ exists, where $a$ and $b$ are two co-prime numbers.

$= 5-\sqrt{3} = \frac{a}{b}$

$= \sqrt{3} = 5 - \frac{a}{b}$, where a and b are integers.

So, $\left(5 - \frac{a}{b}\right)$ is rational.

There arises a contradiction with our assumption becuase $\sqrt{3}$ is an irrational number.

Hence, $5-\sqrt{3}$ is an irrational number.

Q16. If $\mathrm{A} = \{1, 2, 3, 4\}, \mathrm{B} = \{1, 2, 3, 5, 6\}$, then find

(i) $\mathrm{A} \cap \mathrm{B}$,

(ii) $\mathrm{B} \cap \mathrm{A}$

(iii) $\mathrm{A} - \mathrm{B}$,

(iv) $\mathrm{B} - \mathrm{A}$, and what do you observe?

**Solution:**

(i) $\mathrm{A} \cap \mathrm{B} = \{1, 2, 3\}$

(ii) $B \cap A = \{1, 2, 3\}$

(iii) $\mathrm{A} - \mathrm{B} = \{4\}$

(iv) $\mathrm{B} - \mathrm{A} = \{5, 6\}$

Q17. Find the zeroes of the polynomial $p(x) = x^2 - 4x + 3$ and verify the relationship between zeroes and coefficients.

**Solution:**

$x^2 - 4x + 3 = 0$

$x^2 - 3x - x + 3 = 0$

$x(x-3) - 1(x-3) = 0$

$(x-3)(x-1) = 0$

$x = 3, 1$

Sum of the roots $= 3 + 1 = 4 = -\frac{-4}{1} = -4 = \left(-\frac{b}{a}\right)$

Product of the roots $3 \times 1 = 3 = \left(\frac{3}{1}\right) = \left(\frac{c}{a}\right)$

Q18. Solve the quadratic equation $2x^2 + x - 4 = 0$ by completing the square.

**Solution:**

$(a + b)^2 = a^2 + 2ab + b^2$

To find the value of $x$, use the above formula,

To bring the given equation to that form $a^2 + 2ab + b^2$ for some value $a$ & $b$., .

$2x^2 + x - 4 = 0$

$x^2 + \left(\frac{x}{2}\right) - 2 = 0$ [Dividing both the sides by $\frac{1}{2}$ ]

$$x^2 + 2 \times \frac{1}{4}x - 2 = 0$$

Multiplying & dividing the middle term by 2 to get the term 2ab (here $a = x, b = \frac{1}{2}$)

$a^2 + 2ab + c$ (for some value c , here it is -4 ), we need $b^2$ to bring this equation to that form,

By adding $\left(\frac{1}{4}\right)^2$ both the sides,

$$\Rightarrow x^2 + 2 \times \left(\frac{1}{4}\right)x + \left(\frac{1}{4}\right)^2 - 2 = \left(\frac{1}{4}\right)^2$$

It can be, reduced to the form $(a + b)^2$

$$\Rightarrow \left(x + \left[\frac{1}{4}\right]\right)^2 - 2 = \frac{1}{16}$$

$$\Rightarrow \left(x + \left[\frac{1}{4}\right]\right)^2 = \left[\frac{1}{16}\right] + 2$$

$$\Rightarrow \left(x + \left[\frac{1}{4}\right]\right)^2 = \frac{33}{16}$$

By moving the square from LHS to RHS, we get,

$$\Rightarrow x + \frac{1}{4} = \sqrt{\frac{33}{16}}$$

$$\Rightarrow x = \left[\frac{\sqrt{33}-1}{4}\right] \text{ or } \left[\frac{-\sqrt{33}-1}{4}\right]$$

Q19. Solve the equations: $\frac{10}{[x+y]} + \frac{2}{[x-y]} = 4, \frac{15}{[x+y]} \quad - \frac{5}{[x-y]} = -2.$

**Solution:**

Let $\frac{1}{[x+y]} = k$

$$\frac{1}{[x-y]} = m$$

$10k + 2\,m = 4 \times 5$
$15k - 5\,m = -2 \times 2$
$50k + 10\,m = 20$
$30k - 10m = -4$
$80k = 16$
$k = \frac{16}{80} = \frac{1}{5}$
$\frac{1}{[x+y]} = \frac{1}{5}$
$x + y = 5$
$m = \frac{[4 - 10k]}{2} = \frac{[4-2]}{2} = 1$
$\frac{1}{[x+y]} = 1$
$x - y = 1$
$x + y = 5$
$2x = 6$
$x = 3$
$y = 5 - x$
$y = 2$

Q20. Solve the pair of equations by elimination method: $2x + y - 5 = 0$, $3x - 2y - 4 = 0$.

**Solution:**

$(\mathbf{2x + y = 5}) \times \mathbf{2}$
$\mathbf{3x - 2y = 4}$
$\mathbf{4x + 2y = 10} \ldots.(\mathbf{1})$
$3x - 2y = 4 \quad \ldots\ldots..(2)$
$7x = 14$(on adding (1) and (2))
$x = \frac{14}{7} = 2$
$y = 5 - 2x$
$= 5 - 2 \times 2$
$= 1$

Q21. If the sum of the first 7 terms of an AP is 49 and that of 17 terms is 289; find the sum of the first $n$ terms.

**Solution:**

$\text{Sum} = \frac{n}{2}[2a_0 + (n-1)d]$

$49 = \frac{7}{2}[2a_0 + 6\ d]$

$14 = 2a_0 + 6\ d$

$7 = a_0 + 3\ d - - - - (1)$

$289 = \frac{17}{2}[2a_0 + 16\ d]$

$34 = 2a_0 + 16\ d$

$17 = a_0 + 8\ d - - - (2)$

$7 = a_0 + 3\ d$

$17 = a_0 + 8\ d$

$10 = 5\ d$

$d = \frac{10}{5} = 2$

$a_0 = 7 - 3\ d = 7 - 3 \times 2 = 1$

Sum of first $n$ terms $= \frac{n}{2}[2a_0 + [n-1]d]$

$= \frac{n}{2}(2 + 2n - 2)$

$= \frac{n}{2}(2n)$

$= n^2$

Q22. Find the area of the triangle formed by joining the midpoints of the sides of the triangle, whose vertices are $(0,-1)$; $(2,1)$ and $(0,3)$. Find the ratio of this area to the area of the given triangle.

**Solution:**

$\text{D} = \frac{[0+2]}{[2]}, \frac{[-1+1]}{[2]}$

$= (1,0)$

$\text{E} = \frac{[2+0]}{[2]}, \frac{[1+3]}{[2]}$

$= (1,2)$

$\text{F} = \frac{[0+0]}{[2]}, \frac{[3-1]}{[2]}$

$= (0,1)$

Area of triangle $= \frac{1}{2}(0[1-3] + 2[3+1] + 0[-1-1])$

$= \frac{1}{2} \times 8$

$= 4$

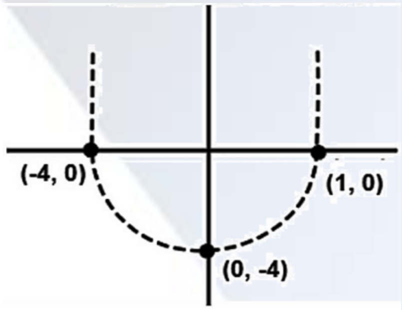
Area of midpoint triangle $= \frac{1}{2}(1[2-1] + 1[1-0] + 0[0-2])$

$= \dfrac{1}{2}$

## SECTION - IV

Q23. Draw the graph of $p(x) = x^2 + 3x - 4$ and find zeroes. Verify the zeroes of the polynomials.

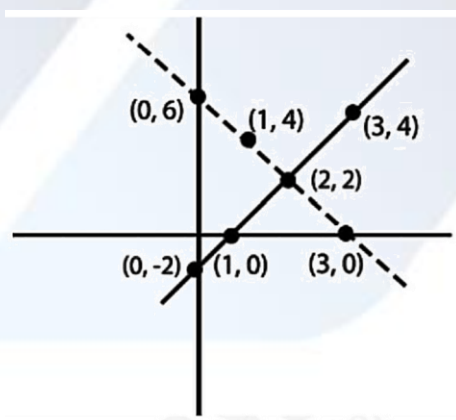
**Solution:**




The graph is an upward parabola as it is a quadratic equation.
The curve passes through $(-4, 0)$ and $(1, 0)$.
The zero of the polynomial is where the curve cut the $x$-axis. i.e. the zero of the polynomials is $-4$ and 1.

Q24. Solve the following equations graphically. $3x - y = 7, 2x + 3y = 1$.

**Solution:**




## PART – B

Q1. If $p$ is prime, then $\sqrt{p}$ is

(A) Composite number

(B) Rational number

(C) Positive integer
(D) Irrational number
**Solution:** D

Q2. Exponential form of $\log_4 8$ is
(A) $x^8 = 4$
(B) $x^4 = 8$
(C) $4^x = 8$
(D) $8^x = 4$
**Solution:** C

Q3. If $\log 625 = k \log 5$, then the value of $k$ is
(A) 5
(B) 4
(C) 3
(D) 2
**Solution:** B

Q4. $\frac{p}{q}$ form of 0.0875 is
(A) $\frac{7}{2^4 \times 5}$
(B) $\frac{7}{2 \times 5^4}$
(C) $\frac{7}{2^4 \times 5^4}$
(D) $5^3$
**Solution:** A

Q5. If $A \subset B, n(A) = 5$ and $n(B) = 7$, then $n(A \cup B) =$
(A) 5
(B) 7
(C) 2
(D) 12
**Solution:** D

Q6. If 2 and 3 are two zeroes $x^3 - 5x^2 + 6x$, then find the third zero.
(A) 1
(B) 4
(C) 5
(D) 0

**Solution:** D

Q7. Which is not a linear equation of the following

(A) $5 + 4x = y + 3$

(B) $x + 2y = y - x$

(C) $3 - x = y^2 + 4$

(D) $x + y = 0$

**Solution:** C

Q8. Two angles are complementary. If the larger angle is twice the measure of the smaller angle, then smaller is

(A) 30

(B) 45

(C) 60

(D) 15

**Solution:** A

Q9. The common difference of AP $1, -1, -3, \dots \dots$ is

(A) -1

(B) 2

(C) -2

(D) 1

**Solution:** C

Q10. Distance between $(0, 7)$ and $(-7, 0)$ is

(A) $2\sqrt{7}$

(B) $7\sqrt{2}$

(C) $\sqrt{14}$

(D) 1

**Solution:** B

Fill in the blanks.

Q11. The decimal form of $\frac{36}{2^3 5^3}$ is

**Solution:**

0.036

*Q12.* If LCM and HCF of two numbers are 108 and 9 respectively and one of them is 54, then the other number is

**Solution:**
18

Q13. If $\log_2 x = 3$, then $x =$
**Solution:**
8

Q14. If $\frac{52}{160} = \frac{13}{2^n 5^m}$, then $m + n$ is
**Solution:**
4

Q15. If the polynomial $p(x) = x^2 - 8x + k$ is divided by $(x - 1)$, the remainder comes out to be ' 6 ', then $k$ is
**Solution:**
13

Q16. The discriminant of the quadratic equation $px^2 + qx + r = 0$ is
**Solution:**
$D = \sqrt{q^2 - 4pr}$

Q17. The first negative number of AP 14,11,8, ... ... is term
**Solution:**
$6^{\text{th}}$

Q18. The intersecting point of $x + y = 6, x - y = 4$ is
**Solution:**
(5,1)

Q19. $(-2,8)$ lies in quadrant
**Solution:**
Second

Q20. Slope of the y-axis is
**Solution:**
Undefined

Find the correct answer for the given questions under group - A selecting from group - $B$.

| Group – A | Group - B |
|---|---|
| Q21. The zero of linear polynomial $ax - b =$ | (A) 0 |
| Q22. If the product of zeroes is ' 0 ' of the polynomial $ax^2 + bx + c$, then the value of $c$ is | (B) -2 |
| | (C) $\frac{b}{a}$ |
| Q23. Product of the zeroes of the polynomial $2x^2 - 3x + 6$ is | (D) $\frac{a}{b}$ |
| Q24. Sum of the zeroes of the polynomial $bx^2 + ax + c =$ | (E) 2 |
| Q25. $\alpha, \beta, \gamma$ are the zeroes of the polynomial $x^3 + 3x^2 - x + 2$, then $\alpha\beta\gamma$ is | (F) $-\frac{a}{b}$ |
| | (G) $-\frac{b}{a}$ |
| | (H) 3 |

**Solution:**

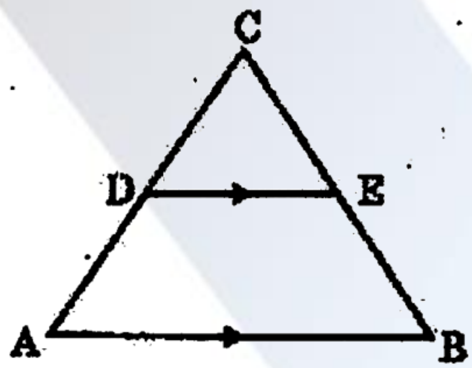
21-C, 22-A, 23-H, 24-F, 25-B

# Paper - II

**SECTION-I**

**PART - A**

Q1. What value of ' $x$ ' will make DE||AB in the given figure. AD $= 8x + 9$, CD $= x + 3$, BE $= 3x + 4$, CE $= x$.




**Solution:**

In $\triangle$ ABC, DE||AB

AD $= 8x + 9$, CD $= x + 3$, BE $= 3x + 4$, CE $= x$

$\frac{CD}{DA} = \frac{CE}{BE}$ [ Thales theorem ]

$\frac{x+3}{8x+9} = \frac{x}{3x+4}$

$(x+3)(3x+4) = x(8x+9)$

$3x^2 + 4x + 9x + 12 = 8x^2 + 9x$

$3x^2 + 13x + 12 = 8x^2 + 9x$

$5x^2 - 4x - 12 = 0$

$5x^2 - 10x + 6x - 12 = 0$

$5x(x-2) + 6(x-2) = 0$

$(x-2)(5x+6) = 0$

$x - 2 = 0$ or $5x + 6 = 0$

Therefore, $x = 2$ or $x = -\frac{6}{5}$

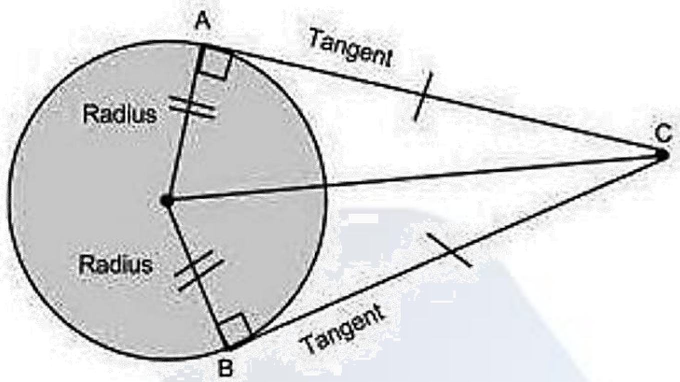
Q2. Find the length of a tangent drawn from a point, which is 15 cm away from the centre of the circle having 9 cm as the radius.

**Solution:**

Let the length of tangent $= x$

Radius $= 9$ cm

Distance to the tangent from centre $= 15$ cm




$(\text{Distance from the centre})^2 = \text{radius}^2 + \text{length of tangent}^2$

$15^2 - 9^2 = \text{length of tangent}^2$

$225 - 81 = \text{length of tangent}^2$

$\text{Length of tangent} = \sqrt{144} = 12 \text{ cm}$

The length of the tangent drawn from a point 15 cm away from the centre of the circle of radius 9 cm is 12 cm.

Q3. Find the volume of a right circular cone with radius 6 cm and height 7 cm .

**Solution:**

$\text{Volume of cone} = \left[\frac{1}{3}\right]\pi r^2 h$

$= \left[\frac{1}{3}\right] \times \left[\frac{22}{7}\right] \times 6 \times 6 \times 7$

$= 264 \text{ cm}^3$

Q4. Find the volume of the sphere of radius 2.1 cm.

**Solution:**

$\text{Radius of sphere} = 2.1 \text{ cm}$

$\text{The volume of sphere} = \left[\frac{4}{3}\right]\pi r^3$

$= \left[\frac{4}{3}\right] \times \left[\frac{22}{7}\right] \times (2.1)^3$

$= 38.80 \text{ cm}^3$

## GROUP - B

Q5. If $\cos A = \frac{12}{13}$. Find $\sin A$ and $\tan A$.

**Solution:**

$$\cos A = \frac{12}{13} - - - (1)$$

By the trigonometric identity,

$\sin^2 A + \cos^2 A = 1$

$\sin^2 A + \left(\frac{12}{13}\right)^2 = 1$

$\sin^2 A + \frac{144}{169} = 1$

$\sin^2 A = 1 - \left(\frac{144}{169}\right)$

$\sin^2 A = \frac{169 - 144}{169}$

$\sin^2 A = \frac{25}{169}$

$\sin A = \sqrt{\left(\frac{5}{13}\right)^2}$

$\sin A = \frac{5}{13} - -(2)$

$\tan A = \frac{\sin A}{\cos A}$

$= \frac{\frac{5}{13}}{\frac{12}{13}}$

$= \frac{5}{12}$

Therefore, $\sin A = \frac{5}{13}, \tan A = \frac{5}{12}$

Q6. A boy observed the top of an electric pole at an angle of elevation of 60° when the observation point is 8 cm away from the foot of the pole. Find the height of the pole.

**Solution:**

Let the height of the electric pole be $H$.

Angle of elevation = 30 degrees

The distance of observer form the base of pole = 10 m

Base = 10

Perpendicular = $H$

$\tan \theta = \frac{\text{perpendicular}}{\text{base}}$

$\tan 30^\circ = \frac{H}{10}$

$\frac{1}{\sqrt{3}} = \frac{H}{10}$

$$\frac{10}{\sqrt{3}} = H$$

Height of the pole is $\frac{10}{\sqrt{3}}$ m.

Q7. A bag contains 5 red and 8 white balls. If a ball is drawn at random from the bag, what is the probability that it will be

[i] a white ball

[ii] not a white ball

**Solution:**

Total number of balls $= 8 + 5 = 13$

[i] Probability of a white ball $= \frac{8}{13}$

[ii] Probability of not a white ball $= 1 - \text{P}$ {of a white ball }

$$= 1 - \left(\frac{8}{13}\right)$$

$$= \frac{5}{13}$$

Q8. Write the formula for the median of grouped data. Explain the terms in words.

**Solution:**

Median $= L + \frac{\frac{n}{2} - cf}{f} \times h$

where, $L$ = lower limit of median class

$n$ = number of observations

$cf$ = cumulative frequency of class preceding the median class

$f$ = frequency of median class

$h$ = class size

**SECTION - II**

Q9. What are similar triangles?

**Solution:**

Any two triangles are said to be similar if their corresponding angles are congruent and the corresponding sides are in proportion. In other words, similar triangles are the same shape, but not necessarily the same size.

Q10. Find the volume of the hemisphere of radius 3.5 cm.

**Solution:**

Radius of hemisphere $= r = 3.5$ cm

The volume of hemisphere $= \left[\frac{2}{3}\right] \pi \text{r}^3$

$= \left[\frac{2}{3}\right] \times \left[\frac{22}{7}\right] \times 3.5 \times 3.5 \times 3.5 \text{ cm}^3$
$= 89.8 \text{ cm}^3$

Q11. Find the probability of getting a head when a coin is tossed once. Also, find the probability of getting a tail.

**Solution:**

$P(E) = \frac{\text{Number of favourable outcome}}{\text{total no of outcomes}}$

Number of favourable outcomes $=$ H, T

$P\ (H) = \frac{1}{2}$

$P(T) = \frac{1}{2}$

Q12. Find the mode of 5, 6, 9, 6, 12, 3, 6, 11, 6, 7.

**Solution:**

A mode is a quantity which occurs most frequently.
Clearly, 6 occurs more times than any other items.
Hence, 6 is the mode of given data.

Q13. If $\tan\ A = \frac{3}{4}$, then find $\sin\ A$.

**Solution:**

$$\sec^2 A = 1 + \frac{9}{16}$$

$$\sec A = \frac{5}{4}$$

$$\sec A = \frac{1}{\cos A}$$

$$\cos A = \frac{4}{5}$$

$$\tan A = \frac{\sin A}{\cos A}$$

$$\frac{3}{4} = \frac{\sin A}{\left[\frac{4}{5}\right]}$$

$\sin A = \frac{3}{5}$

Q14. Find the mean of first ' $n$ ' natural numbers.

**Solution:**

The sum of the first ' $n$ ' natural number is given by $\frac{n[n+1]}{2}$.

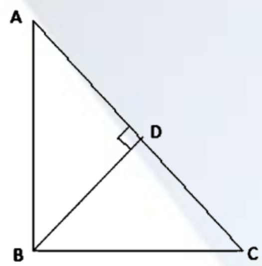
Mean of first ' $n$ ' natural numbers $=\frac{\left\{\frac{n[n+1]}{2}\right\}}{n}=\frac{[n+1]}{2}$

**SECTION - III**

Q15. State and prove Pythagoras theorem.

**Solution:**

In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the other two sides.




Given $\triangle$ ABC in which $\angle ABC = 90°$

To prove: $AC^2 = AB^2 + BC^2$

$\Rightarrow$ Construction:

$\rightarrow$ Draw $BD \perp AC$

$\rightarrow$ Proof:

In $\triangle$ ADB and $\triangle$ ABC,

$\angle A = \angle A$ (common)

$\angle ADB = \angle ABC$ [ each equal to 90° ]

$\therefore \triangle ADB \sim \triangle ABC$ [ By AA-similarity]

$\Rightarrow \frac{AD}{AB}=\frac{AB}{AC}$

$\Rightarrow AB^2 = AD \times AC$

In $\triangle$ BDC and $\triangle$ ABC,

$\angle C = \angle C$ (common)

$\angle BDC = \angle ABC$ [ each equal to 90° ]

$\therefore \triangle BDC \sim \triangle ABC$ [ By AA-similarity ]

$\Rightarrow \frac{DC}{BC}=\frac{BC}{AC}$

$\Rightarrow BC^2 = DC \times AC$

Add equations (1) and (2),

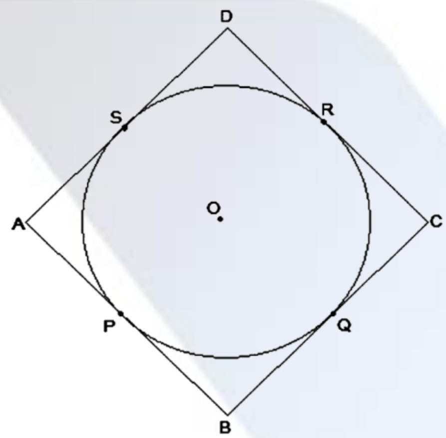
$\Rightarrow AB^2 + BC^2 = AD \times AC + DC \times AC$

$\Rightarrow AB^2 + BC^2 = AC(AD + DC)$

$\Rightarrow AB^2 + BC^2 = AC \times AC$
$\Rightarrow AC^2 = AB^2 + BC^2$

Q16. Prove that the parallelogram circumscribing a circle is a rhombus.

**Solution:**




ABCD is a parallelogram,
$\therefore AB = CD \ldots$ (i)
$\therefore BC = AD \ldots$ (ii)
From the figure,
$DR = DS$ (Tangents to the circle at D )
$CR = CQ$ (Tangents to the circle at C )
$BP = BQ$ (Tangents to the circle at B )
$AP = AS$ (Tangents to the circle at A )
Adding all these,
$DR + CR + BP + AP = DS + CQ + BQ + AS$
$\Rightarrow (DR + CR) + (BP + AP) = (DS + AS) + (CQ + BQ)$
$\Rightarrow CD + AB = AD + BC \ldots$ (iii)
Putting the value of (i) and (ii) in equation (iii) we get,
$2AB = 2BC$
$\Rightarrow AB = BC \ldots$ (iv)
By Comparing equations (i), (ii), and (iv) we get,
$AB = BC = CD = DA$
$\therefore$ ABCD is a rhombus.

Q17. A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding
[i] Minor segment
[ii] Major segment

**Solution:**

Radius r=10cm

Angle $= 90^\circ$

Area of sector A $= \frac{90^\circ}{360^\circ}\pi r^2$

$A = 3.14 \times 10 \times \left[\frac{10}{4}\right]$

$A = 25 \times 3.14$

$A = 78.5$ sq. cm

Let the angle subtended and radius form an arc AOB, then

Area of AOB $= r \times \frac{r \sin 90^\circ}{2}$

$AOB = 10 \times 10 \times \left[\frac{1}{2}\right]$

Area of AOB $= 50$ sq. cm

Area of minor segment $= 78.5 - 50 = 28.5$ sq.. cm

Then area of circle $= \pi r^2$

$= 3.14 \times 10 \times 10$

$= 314$ sq. cm

Area of major segment = area of circle − area of minor segment

$= 314 - 28.5$

$= 285.5$ sq. cm

Q18. A heap of rice is in the form of a cone of diameter 12 m and height 8m. Find its volume. How much canvas cloth is required to cover the heap.

**Solution:**

Given, diameter $= 12$ m

Radius $= 6$ m

Height $= 8$ m

The volume of rice in the heap $= \left(\frac{1}{3}\right)\pi r^2 h$

$= \left(\frac{1}{3}\right) \times \left(\frac{22}{7}\right) \times (6)^2 \times 8$

$= 301.71\ \mathrm{m}^3$Now, $\mathrm{l} = \sqrt{\mathrm{r}^2 + \mathrm{h}^2}$

$= \sqrt{6^2 + 8^2}$

$= 10$ m

∴ Canvas cloth required to cover the heap $= \pi r l$

$= \left(\frac{22}{7}\right) \times 6 \times 10$

$= 188.57\ \mathrm{cm}^2$

**GROUP - B**

Q19. If $\operatorname{cosec}\theta + \cot\ \theta = k$, then show that $\cos\ \theta = \frac{[k^2-1]}{[k^2+1]}$.

**Solution:**

$\operatorname{cosec}\theta + \cot\theta = \mathrm{k}$

$\left[\frac{1}{\sin\theta}\right] + \left[\frac{\cos\theta}{\sin\theta}\right] = \mathrm{k}$

$\frac{[1+\cos\theta]}{\sin\theta} = \mathrm{k}$

$1 + \cos\theta = \mathrm{k}\sin\theta$

On squaring both sides,

$(1+\cos\theta)^2 = k^2\sin^2\theta$

$(1+\cos\theta)(1+\cos\theta) = \mathrm{k}^2(1-\cos^2\theta) = \mathrm{k}^2(1+\cos\theta)(1-\cos\theta)$

$1+\cos\theta = k^2(1-\cos\theta)$

$1+\cos\theta = k^2 - k^2\cos\theta$

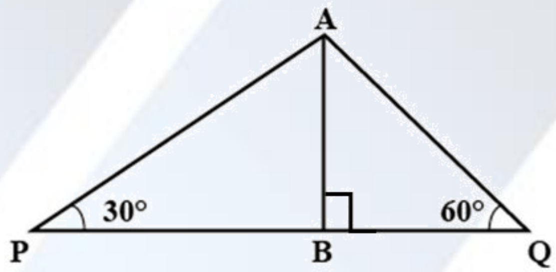
$1+(1+k^2)\cos\theta = k^2$

$(1+k^2)\cos\theta = k^2-1$

$\cos\theta = \frac{[k^2-1]}{[k^2+1]}$

Q20. Two men on either side of a temple of 30 m height observe its top at the angles of elevation 30° and 60° respectively. Find the distance between the two men.

**Solution:**




Given that,

$\mathrm{AB} = 30\ \mathrm{m}, \angle\mathrm{APB} = 30^\circ, \angle\mathrm{AQB} = 60^\circ$

In $\triangle$ ABP,

$\tan\ (\angle\mathrm{APB}) = \frac{\mathrm{AB}}{\mathrm{PB}}$

$\tan\ 30^\circ = \frac{30}{\mathrm{PB}}$

$\mathrm{PB} = 30\sqrt{3}\ \mathrm{m}\left[\tan\ 30^\circ = \frac{1}{\sqrt{3}}\right]$

In $\triangle$ ABQ,

$\tan(\angle AQB) = \frac{AB}{QB}$

$\tan\ 60^\circ = \frac{30}{QB}$

$QB = \frac{30}{\sqrt{3}}[\tan\ 60^\circ = \sqrt{3}]$

$QB = 10\sqrt{3}$ m

Now, $PQ = PB + QB = 30\sqrt{3}$ m $+ 10\sqrt{3}$ m

So, $PQ = 40\sqrt{3}$ m

Therefore, distance between two men, i.e. $PQ = 40\sqrt{3}$ m

Q21. One card is drawn from a well-shuffled pack of 52 cards. Find the probability of getting

[i] a king of red colour

[ii] a face card

[iii] the jack of hearts

[iv] a red face card

[v] a spade

[vi] the queen of the diamond

**Solution:**

Total Cards= 52

i) king of Red colour - 2 King - (HEART & DIAMOND)

Probability of king of red colur $= \frac{2}{52} = \frac{1}{26}$

ii) Face card $= 4 \times 3 = 12$

Probability of Face Card $= \frac{12}{52} = \frac{3}{13}$

iii) Red face Card $= 2 \times 3 = 6$

Probability of Red Face Card $= \frac{6}{52} = \frac{3}{26}$

iv) the jack of hearts = 1

Probability of the jack of hearts $= \frac{1}{52}$

v) a spade = 13

Probability of a spade $= \frac{13}{52} = \frac{1}{4}$

vi) the queen of diamonds = 1

Probability of the queen of diamonds $= \frac{1}{52}$

Q22. The distribution below gives the weights of 30 students in a class. Find the median weight of the students.

| Weight (in kgs) | 40 – 45 | 45 – 50 | 50 – 55 | 55 – 60 | 60 – 65 | 65 – 70 | 70 – 75 |
|---|---|---|---|---|---|---|---|
| Number of students | 2 | 3 | 8 | 6 | 6 | 3 | 2 |

**Solution:**

| Weight (in kgs) | 40 –45 | 45 – 50 | 50 – 55 | 55 – 60 | 60 – 65 | 65 – 70 | 70 – 75 |
|---|---|---|---|---|---|---|---|
| Number of students | 2 | 3 | 8 | 6 | 6 | 3 | 2 |
| Cumulative frequency | 2 | 5 | 13 | 19 | 25 | 28 | 30 |

Here, $n = 30$

$\frac{n}{2} = 15$

Since the cumulative frequency just greater than 15 is 19 and the corresponding class is 55 – 60. Therefore 55 – 60 is the median class.

Here, $l = 55, f = 6, c.f = 13, h = 5$

Median $= 1 + \left[\frac{\frac{n}{2} - cf}{f}\right] \times h$

$= 55 + \left[\frac{15 - 13}{6}\right] \times 5$

$= 55 + \frac{2\times5}{6}$

$= 55 + \frac{10}{6}$

$= 55 + \frac{5}{3}$

$= 55 + 1.667$

$= 56.667 \approx 56.67$

Hence, the median weight of students is 56.67 kg.

**SECTION - IV**

Q23. Construct a triangle of sides 4 cm, 5 cm, and 6 cm , then construct a triangle similar to it, whose sides are $\left(\frac{2}{3}\right)$ of the corresponding sides of the first triangle.

**Solution:**

Steps of Construction:

Step I: AB $=6$ cm is drawn.

Step II: With A as a centre and radius equal to 4 cm , an arc is drawn.

Step III: Again, with B as a centre and radius equal to 5 cm an arc is drawn on the same side of AB intersecting the previous arc at C .

Step IV: AC and BC are joined to form $\triangle$ ABC.

Step V: A ray AX is drawn making an acute angle with AB below it.

Step VI: 5 equal points (sum of the ratio $=2+3=5$ ) is marked on AX as $A_1$ $A_2$ .... $A_5$

Step VII: $A_5$ B is joined. $A_2$ $B'$ is drawn parallel to $A_5$ B and $B'C'$ is drawn parallel to BC.

$\Delta AB'C'$ is the required triangle Justification:

$\angle$ A (Common)

$\angle C=\angle C'$ and $\angle B=\angle B'$ (corresponding angles)

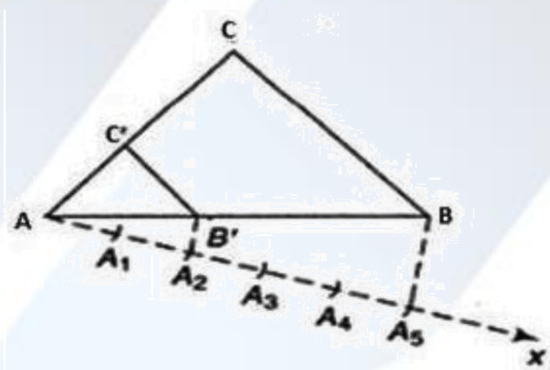
Thus $\triangle AB'C' \sim \triangle ABC$ by AAA similarity condition

From the figure,

$$\frac{AB'}{AB}=\frac{AA_2}{AA_5}=\frac{2}{3}$$

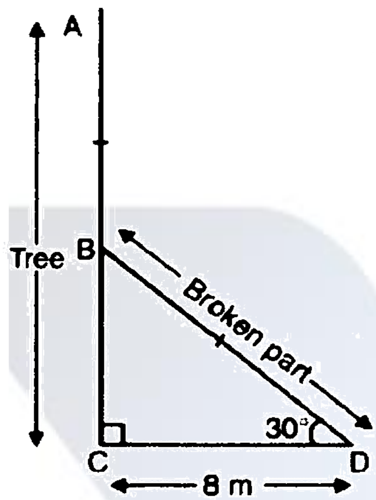
$$AB'=\frac{2}{3AB}$$

$$AC'=\frac{2}{3AC}$$




Q24. A tree breaks due to a storm and the broken part bends so that the top of the tree touches the ground by making 30° angle with the ground. The distance between the foot of the tree and the top of the tree on the ground is 6m. Find the height of the tree before falling down.

**Solution:**




Let the tree be AC and is broken at B . The broken part touches at point D on the ground. In right $\triangle$ BCD,

$$\cos 30^\circ = \frac{CD}{BD}$$

$$\sqrt{\frac{3}{2}} = \frac{8}{BD}$$

$$BD = \frac{16}{\sqrt{3}}$$

$$\tan 30^\circ = \frac{BC}{CD}$$

$$\frac{1}{\sqrt{3}} = \frac{BC}{8}$$

$$BC = \frac{8}{\sqrt{3}}$$

Height of tree $= BC + BD$

$$= \frac{8}{\sqrt{3}} + \frac{16}{\sqrt{3}}$$

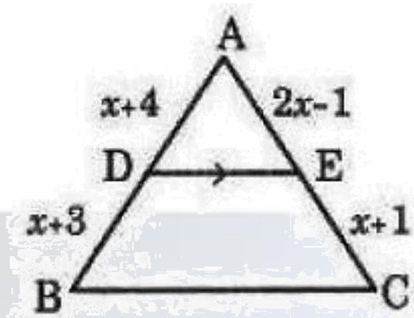
$$= 8\sqrt{3}\text{ m}$$

The height of the tree is $8\sqrt{3}$ m.

**PART - B**

Choose the correct answer.

Q1. In figure DE |BC. Find the value of $x$.




(A) $\sqrt{5}$
(B) $\sqrt{6}$
(C) $\sqrt{3}$
(D) $\sqrt{7}$
**Solution:** D

Q2. Volume of the cone is
(A) $\pi$rh
(B) $\pi r l$
(C) $\pi r(r+l)$
(D) $\left(\frac{1}{3}\right)\pi r^2 h$

**Solution:** D

Q3. If the arithmetic mean of 8,6,4, $x$, 3,6,0, is 4; then the value of $x$ is
(A) 7
(B) 6
(C) 1
(D) 4
**Solution:** C

Q4. Probability of getting a prime or a composite number is
(A) Mutually exclusive
(B) Likely
(C) 0
(D) None
**Solution:** A

Q5. Length of class $11-20$ is
(A) 9

(B) 10
(C) 11
(D) 20
**Solution:** A

Q6. The ratio of volumes of two spheres is 8: 27, then the ratio of surface areas are
(A) 2: 3
(B) 4: 27
(C) 8: 9
(D) 4: 9

**Solution:** D

Q7. In triangle ABC, $\angle B = 90^\circ$, $\sin\ C = \frac{3}{5}$, then $\cos\ A =$
(A) $\frac{3}{5}$
(B) $\frac{4}{5}$
(C) $\frac{5}{4}$
(D) $\frac{5}{3}$
**Solution:** B

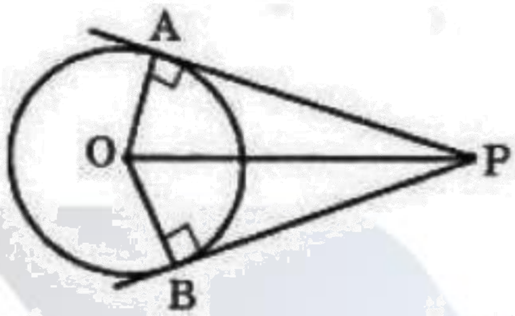
Q8. If a coin is tossed, then the probability that a head turns up is
(A) $\frac{1}{2}$
(B) $\frac{1}{4}$
(C) $\frac{1}{3}$
(D) $\frac{1}{6}$

**Solution:** A

Q9. If $x = \sin\ \theta, y = \cos\ \theta$, then which of the following is true?
(A) $x^2 + y^2 = 1$
(B) $x^2 - y^2 = 1$
(C) $\frac{x}{y} = 1$
(D) $xy = 1$

**Solution:** A

Q10. In the figure, if $\angle APB = 60^\circ$ and $OP = 10$ cm, then $PA =$ cm.




(A) 5
(B) $5\sqrt{2}$
(C) $5\sqrt{3}$
(D) 20
**Solution:** C

Fill in the blanks with suitable answers.

Q11. Sum of central angles in a circle is

**Solution:**

**$360^{\circ}$**

Q12. Football is an example of

**Solution:**

Sphere

Q13. Arithmetic mean of $a-2, a, a+2$ is

**Solution:**

$a$

Q14. $\mathrm{P(E)}+\mathrm{P}(\text{ not } E)=$

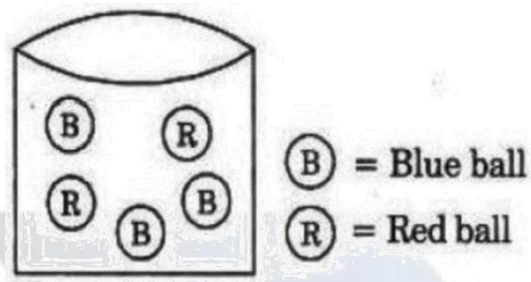
**Solution:**

1

Q15. From the figure, the probability of getting a blue colour ball is

**Solution:**

0.6




Q16. In triangle ABC, $AC^2 = AB^2 + BC^2$, then the right angle is at

**Solution:**

B

Q17. Base area of a circular cylinder is 154 $cm^2$. Then its radius is (7 cm)

**Solution:**

7 cm

Q18. Curved surface area of a hemisphere with radius ' $r$ ' is

**Solution:**

$2\pi r^2$

Q19. Arithmetic mean of $1,2,x,3$ is 0, then $x =$ (-6)

**Solution:**

$-6$

Q20. $\sin(60^\circ + 30^\circ) =$ (1)

**Solution:**

1

Find the correct answer for the given question under group - A selecting from group - B.

| Group -A | Group - B |
| --- | --- |
| Q21. Number of chords of a circle is | (A) 5.1 |
| Q22. In a circle $d = 10.2$ cm, | (B) $\frac{\sqrt{3}a}{2}$ |
| then $r =$ cm. | (C) Infinite |
| Q23. Perimeter of a semi-circle, | (D) $90^\circ$ |

| | |
|---|---|
| whose radius is ' $r$ ' = | (E) $\sqrt{\frac{3a}{2}}$ |
| Q24. The height of an equilateral triangle, | (F) 45° |
| whose side is ' $a$ ' units = | (G) $\frac{36}{7}r$ |
| Q25. If $\triangle$ ABC $\sim \triangle$ XYZ; $\angle C = 60°, \angle B = 75°$, then $\angle X = \cdots$.. | (H) 0 |

**Solution:**

21 - (C), 22 - (A), 23 - (G), 24 - (B), 25 - (F)

(ii)

| Group – A | Group - B |
|---|---|
| Q26. If $\sec\ \theta + \tan\ \theta = \frac{1}{2}$, | (I) $\sin\ \theta$ |
| then $\sec\ \theta - \tan\ \theta =$ | (J) 0.35 |
| Q27. $\cos\ (90 - \theta) =$ | (K) 28 |
| Q28. If $P(E) = 0.65$, | (L) 30° |
| then $P(\bar{E}) =$ | (M) 0 |
| Q29. If $\sin\ \theta = \cos\ \theta$, | (N) 2 |
| then $\theta =$ | (O) $\cos\theta$ |
| Q30. Sum of 15 observations is 420, | (P) 45° |
| then A.M. = | |

**Solution:**

26 - (N), 27 - (I), 28 -(J), 29 - (P), 30 - (K)