QR Code Questions

1. Relations and Functions

1. If $f : R \to R$ defined by $f(x) = x^2 + 2$, then the pre-images of 27 are
(1) $5, -5$ (2) $\sqrt{5}, -\sqrt{5}$ (3) $5, 0$ (4) $0, 5$

$f(x) = x^2 + 2$

$f(5) = 5^2 + 2 = 25 + 2 = 27$

$f(-5) = (-5)^2 + 2 = 25 + 2 = 27$

Pre-images of 27 are $5, -5$

2. If $f\left(x - \frac{1}{x}\right) = x^2 + \frac{1}{x^2}$, then $f(x) =$ ________ .
(1) $x^2 + 2$ (2) $x^2 - 2$ (3) $x^2 + \frac{1}{x^2}$ (4) $x^2 - \frac{1}{x^2}$

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

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

$= \left[x^2 + \frac{1}{x^2} - 2x \times \frac{1}{x}\right] + 2$

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

$= x^2 + \frac{1}{x^2}$

$\therefore f(x) = x^2 + 2$

3. If $A = \{a, b, c\}, B = \{2, 3\}$ and $C = \{a, b, c, d\}$ then $n[(A \cap C) \times B]$ is
(1) 4 (2) 8 **(3) 6** (4) 12

$A = \{a, b, c\}, \quad B = \{2, 3\}, \quad c = \{a, b, c, d\}$

$A \cap C = \{a, b, c\} \cap \{a, b, c, d\}$

$= \{a, b, c\}$

$(A \cap C) \times B = \{a, b, c\} \times \{2, 3\}$

$= \{(a, 2)\ (a, 3)\ (b, 2)\ (b, 3)\ (c, 2)\ (c, 3)\}$

$n[(A \cap C) \times B] = 6$

4. If the ordered pairs $(a, 1)$ and $(5, b)$ belong to $\{(x, y) / y = 2x + 3\}$, then the values of a and b are
(1) $-13, 2$ (2) $2, 13$ (3) $2, -13$ **(4) $-2, 13$**

$\{(x, y)/y = 2x + 3\}, (a, -1)\ (5, b); a, b = ?$

$y = 2x + 3$

$(a, -1) \Rightarrow -1 = 2a + 3$

$2a = -1 - 3$

$(5, b) \Rightarrow b = (2 \times 5) + 3$

$b = 10 + 3$

$2a = -4 \qquad\qquad b = 13$

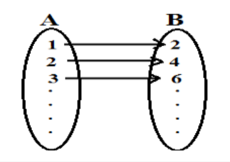
$a = \frac{-4}{2} = -2$

$a = -2$

$\therefore a = -2,\ b = 13$

5. The function $f : \mathbb{N} \to \mathbb{N}$ is defined by $f(x) = 2x$. Then the function f is
(1) Not one-one but onto (2) one-one but not onto
(3) one-one and onto (4) not one-one and not onto

$f(x) = 2x;\quad f: N \to N$
$f(1) = 2(1) = 2$
$f(2) = 2(2) = 4$
$f(3) = 2(3) = 6$
one-one and onto



6. If $f(x) = x + 1$, then $f\left(f\left(f(y+2)\right)\right)$ is
(1) $y + 3$ **(2) $y + 5$** (3) $y + 7$ (4) $y + 9$

$f(y+2) = y + 2 + 1 = y + 3$
$f\left(f(y+2)\right) = f(y+3) = y + 3 + 1 = y + 4$
$f\left(f\left(f(y+2)\right)\right) = f(y+4) = y + 4 + 1 = y + 5$

7. The function t which maps temperature in degree Celsius into temperature in degree Fahrenheit is defined by $t(c) = \frac{9c}{5} + 32$. The Fahrenheit degree is 95 then the value of c will be
(1) 37 (2) 36 **(3) 35** (4) 29

$t(c) = \frac{9c}{5} + 32$
$t(35) = \frac{9}{5} \times 35 + 32 = 63 + 32 = 95$
the value of $c = 35$

8. If $f(x) = mx + n$, where m and n are integers, $f(-2) = 7$ and $f(3) = 2$, then m and n are equal to
(1) $-1, 5$ (2) $-1, -5$ (3) $1, -9$ (4) $1, 9$

$f(x) = mx + n,\ f(-2) = 7,\ f(3) = 2,\ m, n = ?$
$f(-2) \Rightarrow m(-2) + n = 7$
$f(3) \Rightarrow m(3) + n = 2$
$-2m + n = 7$ ………… (1)
$3m + n = 2$ ………….. (2)
Solve (1), (2)

$$\begin{array}{rcl} -2m + n &=& 7 \\ 3m + n &=& 2 \\ (-) \quad (-) & & (-) \\ \hline -5m \quad &=& 5 \\ \hline \end{array}$$

$m = \frac{5}{-5} \Rightarrow m = -1$
Sub $m = -1$ in (2)
$3m + n = 2$
$3(-1) + n = 2$

$$-3+n=2$$
$$n=2+3$$
$$n=5 \qquad (m,n)=(-1,5)$$

9. If $f(x)=ax-2,\ g(x)=2x-1$ and $f\circ g=g\circ f$, then the value of a is

(1) -3 **(2) 3** (3) $\frac{1}{3}$ (4) 13

$$f(x)=ax-2,\ g(x)=2x-1 \Rightarrow f\circ g=g\circ f$$
$$a=?$$
$$f\circ g=f[g(x)]=f(2x-1)$$
$$=a(2x-1)-2$$
$$=2ax-a-2 \text{ .... (I)}$$
$$g\circ f=g[f(x)]=g(ax-2)$$
$$=2(ax-2)-1$$
$$=2ax-4-1$$
$$=2ax-5 \text{ .... (II)}$$
$$(I)=(II)\Rightarrow 2ax-a-2=2ax-5$$
$$2ax-2ax-a-2=-5$$
$$-a=-3$$
$$a=3$$

10. If f is a identity function, then the value of $f(1)-2f(2)+f(3)$ is

(1) 1 **(2) 0** (3) -1 (4) -3

$$f(1)-2f(2)+f(3)=?$$
$$x=x;\ \ f(1)=1,\ f(2)=2,\ f(3)=3$$
$$f(1)-2f(2)+f(3)=1-(2\times 2)+3$$
$$=4-4=0$$

11. If $f(x)=\frac{1}{x}$ and $g(x)=\frac{1}{x^3}$, then $f\circ g\circ f(y)$ is

(1) $\frac{1}{y^8}$ (2) $\frac{1}{y^6}$ (3) $\frac{1}{y^4}$ **(4) $\frac{1}{y^3}$**

$$f(x)=\frac{1}{x},\ g(x)=\frac{1}{x^3}$$
$$f\circ g\circ f(y)=?$$
$$f\circ g\circ f(y)\Rightarrow g\circ f(y)$$
$$f(x)=\frac{1}{x};f(y)=\frac{1}{y}$$
$$g(x)=\frac{1}{x^3}$$
$$\therefore g\left(\frac{1}{y}\right)=\frac{1}{\left(\frac{1}{y}\right)^3}=y^3$$
$$g\circ f(y)=y^3$$
$$f\circ g\circ f(y)\Rightarrow f(y^3)=\frac{1}{y^3}$$

12. If $f(x)=2-3x$ then $f\circ f(1-x)=?$

(1) $9x-5$ (2) $5x-9$ (3) $5x+9$ **(4) $5-9x$**

$f(x) = 2 - 3x,\ f \circ f(1-x) = ?$

$$\begin{aligned} f \circ f(1-x) &= f[f(1-x)] \\ &= f(2-3x) = f\big[f\big(2-3(1-x)\big)\big] = f[f(2-3+3x)] \\ &= f[f(3x-1)] \\ &= 2-3(3x-1) \\ &= 2-9x+3 \\ &= 5-9x \end{aligned}$$

13. If $f(x) + f(1-x) = 2$ then $f\left(\frac{1}{2}\right)$ is

(1) 1 (2) -1 (3) 5 (4) -9

$x = \frac{1}{2}$

$$f\left(\frac{1}{2}\right) + f\left(1-\frac{1}{2}\right) = 2$$

$$f\left(\frac{1}{2}\right) + f\left(\frac{1}{2}\right) = 2$$

$$2f\left(\frac{1}{2}\right) = 2$$

$$f\left(\frac{1}{2}\right) = 1$$

14. If f is a constant function of value $\frac{1}{10}$. Then the value of $f(1) + f(2) + \ldots\ldots\ldots + f(100)$ is

(1) $\frac{1}{10}$ **(2) 10** (3) 100 (4) $\frac{1}{100}$

f is a constant function then there is no change of the value if x varies so

$$\begin{aligned} f(1) + f(2) + \ldots\ldots\ldots + f(100) &= \frac{1}{10} + \frac{1}{10} + \ldots\ldots + \frac{1}{10} \\ &= \frac{1+1+\ldots\ldots+1}{10} = \frac{100}{10} \\ &= 10 \end{aligned}$$

15. If $f(x) = \frac{x+1}{x-2}$ and $g(x) = \frac{1+2x}{x-1}$ then $f \circ g(x)$ is

(1) Constant function **(2) Identity function**

(3) Quadratic function (4) Cubic function

$f(x) = \frac{x+1}{x-2},\ g(x) = \frac{1+2x}{x-1},\ f \circ g(x)$

$$f \circ g(x) = f[g(x)] = f\left(\frac{1+2x}{x-1}\right)$$

$$= \frac{\frac{1+2x}{x-1} + 1}{\frac{1+2x}{x-1} - 2} = \frac{\frac{1+2x+x-1}{x-1}}{\frac{1+2x-2x+2}{x-1}} = \frac{3x}{3} = x$$

(2) Identity function

2. Numbers and Sequences

1. What is the HCF of the least prime number and the least composite number?

(1) 1 **(2) 2** (3) 3 (4) 4

The HCF of the least prime number and the least composite number is 2

2. If ‘a’ and ‘b’ are two positive integers where $a > b$ and ‘b’ is a factor of ‘a’ then HCF of (a, b) is

(1) b (2) a (3) ab (4) $\frac{a}{b}$

If ‘a’ and ‘b’ are two positive integers where $a > b$ and ‘b’ is a factor of ‘a’ then HCF of (a, b) is b

3. If m and n are co-prime numbers, then m^2 and n^2 are

(1) co-prime (2) not co-prime (3) even (4) odd

If m and n are co-prime numbers, then m^2 and n^2 are co-prime

4. If 3 is the least prime factor of number a and 7 is the least prime factor of b then the least prime factor of $a + b$ is

(1) $a + b$ **(2) 2** (3) 5 (4) 10

If 3 is the least prime factor of number a and 7 is the least prime factor of b then the least prime factor of $a + b$ is

$$a + b = 3 + 7$$
$$= 10$$

The least prime factor of ‘10’ is 2

5. The remainder when the difference between 60002 and 601 is divided by 6 is

(1) 2 **(2) 1** (3) 0 (4) 3

Difference $= 60002 - 601$
$= 59401$
Remainder $= 1$

9900
6 | 59401
54
54
54
001

6. $44 \equiv 8(mod\ 12)$, $113 \equiv 5(mod\ 12)$, thus $44 \times 113 \equiv$ _________ $(mod\ 12)$

(1) 4 (2) 3 (3) 2 (4) 1

Here $44 \times 113 = \underline{8 \times 5}\ (mod\ 12)$
$= 40\ (mod\ 12)$
$= 4\ (mod\ 12)$

3
12 | 40
36
4

7. Given $a_1 = -1$ and $a_n = \frac{a_{n-1}}{n+2}$ then a_4 is

(1) $\frac{-1}{20}$ (2) $\frac{-1}{4}$ (3) $\frac{-1}{840}$ **(4) $\frac{-1}{120}$**

$a_1 = -1,\ a_n = \frac{a_{n-1}}{n+2};\quad a_4 = ?$

$$a_2 = \frac{a_{2-1}}{2+2} = \frac{a_1}{4} = \frac{-1}{4}$$

$$a_3 = \frac{a_{3-1}}{3+2} = \frac{a_2}{5} = \frac{\frac{-1}{4}}{5} = \frac{-1}{20}$$

$$a_4 = \frac{a_{4-1}}{4+2} = \frac{a_3}{6} = \frac{\frac{-1}{20}}{6} = \frac{-1}{120}$$

8. The first term of an A.P. whose 8th and 12th terms are 39 and 59 respectively
(1) 5 (2) 6 **(3) 4** (4) 3

$t_8 = 39,\ t_{12} = 59,\ a = ?$

$t_8 \Rightarrow\ a + 7d = 39$

$t_{12} \Rightarrow \cancel{a} + 11d = 59$ .... (1)

$\cancel{a} +\ 7d = 39$ .... (2)

$(-)\ (-)\quad (-)$

$4d = 20$

$d = \frac{20}{4} = 5$

Sub $d = 5$ in (2) $a + 35 = 39$

$a = 39 - 35$

$a = 4$

9. In the arithmetic series, $S_n = k + 2k + 3k + \ldots\ldots + 100$, k is a positive integer and k is a factor of 100 then S_n is
(1) $5000 + \frac{50}{k}$ **(2) $\frac{5000}{k} + 50$** (3) $\frac{1000}{k} + 10$ (4) $1000 + \frac{10}{k}$

If $k = 1$

$S_n = 1 + 2 + 3 + \ldots\ldots + 100$

$S_n = \frac{n}{2}[a + l] = \frac{100}{2}(1 + 100)$

$= 50(101)$

$= 5050$

Find the right answer from given options, we choose option (2), $\frac{5000}{k} + 50 = \frac{5000}{1} + 50$

$= 5000 + 50 = 5050$

10. How many terms are there in the G.P. $5, 20, 80, 320, \ldots\ldots, 20480$?
(1) 5 (2) 6 **(3) 7** (4) 9

$5, 20, 80, 320, \ldots\ldots 20480 \rightarrow$ G.P, $n = ?$

$t_n \Rightarrow ar^{n-1} = 20480$

$a = 5, r = \frac{20}{5} = 4$

$5 \times (4)^{n-1} = 20480 \Rightarrow 4^{n-1} = \frac{20480}{5} = 4096$

$4^{n-1} = 4^6$

$n - 1 = 6$

$n = 6 + 1 = 7;$

$n = 7$

$$\begin{array}{r|l} 4 & 4096 \\ \hline 4 & 1024 \\ \hline 4 & 256 \\ \hline 4 & 64 \\ \hline 4 & 16 \\ \hline 4 & 4 \\ \hline & 1 \end{array}$$

11. If p^{th}, q^{th} and r^{th} terms of an A.P. are a, b, c respectively then $a(q-r)+b(r-p)+c(p-q)$ is

(1) 0 (2) $a+b+c$ (3) $p+q+r$ (4) pqr

$p^{th} \to a$, $q^{th} \to b$, $r^{th} \to c$

Here $q-r=b-c$

$r-p=c-a$

$p-q=a=b$

So $a(q-r)+b(r-p)+c(p-q)=a(b-c)+b(c-a)+c(a-b)$

$=ab-ac+bc-ab+ac-bc$

$=0$

12. Sum of infinite terms of a G.P is 12 and the first terms is 8. What is the fourth term of the G.P?

(1) $\frac{8}{27}$ (2) $\frac{4}{27}$ (3) $\frac{8}{20}$ (4) $\frac{1}{3}$

In G.P $\Rightarrow S_\infty = 12,\ a=8,\ t_4=?$

$S_\infty \Rightarrow \frac{a}{1-r}=12,\ a=8,\ t_4=ar^{4-1}$

$\frac{8}{1-r}=12 \Rightarrow 8=12-12r$

$8-12=-12r$

$-4=-12r$

$\frac{-4}{-12}=r$

$r=\frac{1}{3}$

If $a=8,\ r=\frac{1}{3}$

$t_4=8\times\left(\frac{1}{3}\right)^3=8\times\frac{1}{27}$

$t_4=\frac{8}{27}$

13. A boy saves B1 on the first day B2 on the second day, B4 on the third day and so on. How much did the boy will save up to 20 days?

(1) $2^{19}+1$ (2) $2^{19}-1$ **(3) $2^{20}-1$** (4) $2^{11}-1$

1 day → B1, 2nd day → B2, 3rd day → B4

20 days → ?

$1+2+4+\ldots\ldots.$

$a=1,\ r=\frac{2}{1}=2;\ S_{20}=?\quad a=1, r>1;$

$S_n=\frac{a(r^n-1)}{r-1}$

$=\frac{(2^{20}-1)}{2-1}=\frac{2^{20}-1}{1}=2^{20}-1$

14. The sum of first 'n' terms of the series $a, 3a, 5a, \ldots.$ is

(1) na (2) $(2n-1)a$ **(3) n^2a** (4) n^2a^2

$a, 3a, 5a, \ldots\ldots\ldots S_n=?$

$a(1+3+5+\ldots\ldots.+n)=a(n^2)$

The sum of first 'n' terms of the series n^2a

15. If p, q, r, x, y, z are in A.P, then $5p+3, 5q+3, 5r+3, 5x+3, 5y+3, 5z+3$ form

(1) a G.P **(2) an A.P**

(3) a constant sequence (4) neither an A.P nor a G.P

p, q, r, x, y, z → A.P

$5p+3, 5q+3, 5r+3, 5x+3, 5y+3, 5z+3$ is an A.P

(common difference same)

16. In an A.P if the p^{th} term is 'q' and the q^{th} term is p, then its n^{th} term is

(1) $\boldsymbol{p+q-n}$ (2) $p+q+n$ (3) $p-q+n$ (4) $p-q-n$

$t_p = q,\ t_q = p,\ t_n = ?$

$t_p \Rightarrow \cancel{a} + (p-1)d = q$ .... (1)

$t_q \Rightarrow \cancel{a} + (q-1)d = p$ .... (2)

$\underline{\quad(-)\quad(-)\qquad\quad(-)\quad}$

$(p-1-q-1)d = q-p$

$(p-q)d = q-p$

$(p-q)d = -(p-q)$

$d = -1$

$d = -1$ in (1)

$a + (p-1)(-1) = q$

$a - p + 1 = q$

$a = q + p - 1$

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

Substitute $a = p + q - 1,\ \ d = -1$

$t_n = p + q - 1 + (n-1)(-1)$

$= p + q - 1 - n + 1$

$\therefore t_n = p + q - n$

17. A square is drawn by joining the mid points of the sides of a given square in the same way and this process continues indefinitely. If the side of the first square is $4\ cm$, then the sum of the areas of all the squares is

(1) $8\ cm^2$ (2) $16\ cm^2$ **(3) $\boldsymbol{32\ cm^2}$** (4) $64\ cm^2$

Area of Ist square $= 4^2 = 16\ cm^2$

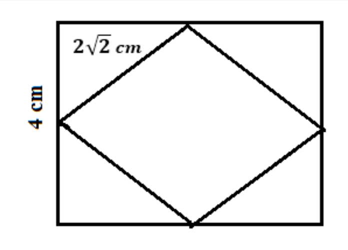
Area of IInd square $= \left(2\sqrt{2}\right)^2 = 4 \times 2 = 8\ cm^2$

G.P $16 + 8 + \ldots\ldots$

$a = 16 \quad r = \frac{8}{16} = \frac{1}{2}$

$S_\infty = \frac{a}{1-r} = \frac{16}{1-\frac{1}{2}} = \frac{16}{\frac{1}{2}}$

$= 16 \times \frac{2}{1} = 32\ cm^2$



18. Sum of first 'n' terms of the series $\sqrt{2} + \sqrt{8} + \sqrt{18} + \ldots\ldots$ is

(1) $\frac{n(n+1)}{2}$ (2) $\sqrt{n}$ **(3) $\boldsymbol{\frac{n(n+1)}{\sqrt{2}}}$** (4) 1

$\sqrt{2} + \sqrt{8} + \sqrt{18} + \ldots\ldots S_n = ?$

$a = \sqrt{2}, \quad d = \sqrt{8} - \sqrt{2}$

$= \sqrt{4 \times 2} - \sqrt{2}$

$= 2\sqrt{2} - \sqrt{2}$

$= 1\sqrt{2}$

$S_n = \frac{n}{2}[2a + (n-1)d]$

$$= \frac{n}{2}\left[(2 \times \sqrt{2}) + (n-1)(\sqrt{2})\right]$$
$$= \frac{n}{2}\left[2\sqrt{2} + \sqrt{2}n - \sqrt{2}\right]$$
$$= \frac{n}{2}\left[\sqrt{2} + \sqrt{2}n\right]$$
$$= \frac{n}{2}\left[\sqrt{2}(1+n)\right] = \frac{n(n+1)\sqrt{2}}{\sqrt{2}\times\sqrt{2}} = \frac{n(n+1)}{\sqrt{2}}$$

3. Algebra

1. Which of the following are linear equation in three variables

(i) $2X = z$ (ii) $2\sin X + Y\cos Y + Z\tan Z = 2$

(iii) $X + 2Y^2 + Z = 3$ (iv) $X - Y - Z = 7$

(1) (i) and (iii) only (2) (i) and (iv) only

(3) (iv) only (4) All

linear equation in three variables $X - Y - Z = 7$

2. The HCF of two polynomials $p(x)$ and $q(x)$ is $2x\ (x+2)$ and LCM is $24x\ (x+2)^2\ (x-2)$. If $p(x) = 8x^3 + 32x^2 + 32x$ then $q(x)$ is equal to

(1) $4x^3 - 16x$ **(2) $6x^3 - 24x$** (3) $12x^3 + 24x$ (4) $12x^3 - 24x$

$p(x) = 8x^3 + 32x^2 + 32x$

HCF of $p(x)$ and $q(x) = 2x(x+2)$

LCM of $p(x)$ and $q(x) = 24x\ (x+2)^2\ (x-2)$

$p(x) \times q(x) =$ HCF of $p(x)$ and $q(x) \times$ LCM of $p(x)$ and $q(x)$

$$q(x) = \frac{\text{HCF of } p(x) \text{ and } q(x) \times \text{LCM of } p(x) \text{ and } q(x)}{p(x)}$$

$$= \frac{2x\ (x+2)\times\left[24x(x+2)^2\ (x-2)\right]}{8x^3+32x^2+32x}$$

$[8x^3 + 32x^2 + 32x = 8x(x^2 + 4x + 4) = 8x(x+2)^2]$

$$= \frac{2x(x+2)\times 24x(x+2)^2(x-2)}{8x\ (x+2)^2}$$

$= 6x\ (x+2)\ (x-2)$

$= 6x\ (x^2 - 4)$

$q(x) = 6x^3 - 24x$

3. Graphically an infinite number of solutions represents

(1) three planes with no point in common

(2) three planes intersecting at a single point

(3) three planes intersecting in a line or coinciding with one another

(4) None

An infinite number of solutions represents three planes intersecting in a line or coinciding with one another

4. Which of the following is correct

(i) Every polynomial has finite number of multiples

(ii) LCM of two polynomials of degree 2 may be a constant

(iii) HCF of 2 polynomials may be a constant

(iv) Degree of HCF of two polynomials is always less then degree of LCM.

(1) (i) and (ii) (2) (iii) and (iv) **(3) (iii) only** (4) (iv) only

HCF of 2 polynomials may be a constant

5. Consider the following statements:

(i) The HCF of $X+Y$ and X^8-Y^8 is $X+Y$

(ii) The HCF of $X+Y$ and X^8+Y^8 is $X+Y$

(iii) The HCF of $X-Y$ and X^8+Y^8 is $X-Y$

(iv) The HCF of $X-Y$ and X^8-Y^8 is $X-Y$

Which of the statements given above are correct?

(1) (i) and (ii) (2) (ii) and (iii) **(3) (i) and (iv)** (4) (ii) and (iv)

Correct statements are (i) and (iv)

6. For what set of values $\frac{x^2+5x+6}{x^2+8x+15}$ is undefined

(1) $-3,-5$ (2) -5 (3) $-2,-3,-5$ (4) $-2,-3$

For undefined

$x^2+8x+15=0$

$(x+3)(x+5)=0$

So for $x=-3$ (or) -5

$x^2+8x+15=0$ then only $\frac{x^2+5x+6}{x^2+8x+15}$ is undefined

7. $\frac{x^2+7x+12}{x^2+8x+15}\times\frac{x^2+5x}{x^2+6x+8}$

(1) $x+2$ **(2) $\frac{x}{x+2}$** (3) $\frac{35x^2+60x}{48x^2+120}$ (4) $\frac{1}{x+2}$

$\frac{x^2+7x+12}{x^2+8x+15}\times\frac{x^2+5x}{x^2+6x+8}$

$=\frac{(x+4)(x+3)}{(x+5)(x+3)}\times\frac{x(x+5)}{(x+4)(x+2)}=\frac{x}{x+2}$

8. If $\frac{p}{q}=a$ then $\frac{p^2+q^2}{p^2-q^2}$ is

(1) $\frac{a^2+1}{a^2-1}$ (2) $\frac{1+a^2}{1-a^2}$ (3) $\frac{1-a^2}{1+a^2}$ (4) $\frac{a^2-1}{a^2+1}$

$\frac{p}{q}=a$ divide $\frac{p^2+q^2}{p^2-q^2}$ by q^2

$$= \frac{\frac{p^2}{q^2}+\frac{q^2}{q^2}}{\frac{p^2}{q^2}-\frac{q^2}{q^2}}$$

$$= \frac{\left(\frac{p}{q}\right)^2+1}{\left(\frac{p}{q}\right)^2-1}$$

$$= \frac{a^2+1}{a^2-1} \qquad \left(\because \frac{p}{q}=a\right)$$

Ans: (1) $\frac{a^2+1}{a^2-1}$

9. The square root of $4m^2-24m+36=0$ is

(1) $4(m-3)$ **(2) $2(m-3)$** (3) $(2m-3)^2$ (4) $(m-3)$

$4m^2-24m+36=0$

$4(m^2-6m+9)=0$

$\sqrt{4(m-3)^2}=0$

$2(m-3)=0$

10. The real roots of the quadratic equation $x^2-x-1=0$ are

(1) 1, 1 (2) −1, 1 **(3) $\frac{1+\sqrt{5}}{2},\frac{1-\sqrt{5}}{2}$** (4) No real roots

$x^2-x-1=0$

$a=1,\ b=-1,\ c=-1$

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$=\frac{-(-1)\pm\sqrt{(-1)^2-4(1)(-1)}}{(2\times1)}$$

$$=\frac{1\pm\sqrt{1+4}}{2}$$

$$=\frac{1\pm\sqrt{5}}{2}$$

$$\therefore x=\frac{1+\sqrt{5}}{2},\frac{1-\sqrt{5}}{2}$$

11. Axis of symmetry in the term of vertical line separates parabola into

(1) 3 equal halves (2) 5 equal halves **(3) 2 equal halves** (4) 4 equal halves

Axis of symmetry in the term of vertical line separates parabola into 2 equal halves

12. The parabola $y=-3x^2$ is

(1) Open upward **(2) Open downward** (3) Open rightward (4) Open leftward

The parabola $y=-3x^2$ is open downward

13. The product of the sum and product of roots of equation

$(a^2-b^2)x^2-(a+b)^2x+(a^3-b^3)=0$ is

(1) $\frac{a^2+ab+b^2}{a-b}$ (2) $\frac{a+b}{a-b}$ (3) $\frac{a-b}{a+b}$ (4) $\frac{a-b}{a^2+ab+b^2}$

$(a^2-b^2)x^2-(a+b)^2+(a^3-b^3)=0$

$a = (a^2 - b^2)$

$= (a + b)(a - b)$

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

$= -(a + b)(a + b)$

$c = (a^3 - b^3)$

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

Sum of the roots $\alpha + \beta = \frac{-b}{a}$

$= \frac{-(-(a+b)(a+b))}{(a+b)(a-b)}$

$= \left(\frac{a+b}{a-b}\right)$

Products of the roots $\alpha\beta = \frac{c}{a}$

$= \frac{(a-b)(a^2+ab+b^2)}{(a+b)(a-b)}$

$= \frac{a^2+ab+b^2}{a+b}$

The product of the sum and product of roots $= \frac{a+b}{a-b} \times \frac{a^2+ab+b^2}{a+b}$

$= \frac{a^2+ab+b^2}{a-b}$

14. A quadratic polynomial whose one zero is 5 and sum of the zeros is 0 is given by

(1) $x^2 - 25$ (2) $x^2 - 5$ (3) $x^2 - 5x$ (4) $x^2 - 5x + 5$

A quadratic polynomial whose one zero is 5 and sum of the zeroes is 0. The polynomial equation is

$x^2 - (\text{sum of the roots})x + (\text{Product of the roots})$

$\alpha + \beta = 0$

$5 + \beta = 0$

$\beta = 0 - 5$

$\beta = -5$

$x^2 - (5 - 5)x + (5 \times -5)$

$x^2 - 0x - 25$

∴The quadratic polynomial is $x^2 - 25$

15. Choose the correct answer

(i) Every scalar matrix is an identity matrix (ii) Every identity matrix is a scalar matrix

(iii) Every diagonal matrix is an identity matrix (iv) Every null matrix is a scalar matrix

(1) (i) and (iii) only (2) (iii) only (3) (iv) only **(4) (ii) and (iv) only**

16. If $2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$ and $A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$ then $B =$

(1) $\begin{bmatrix} 8 & -1 & -2 \\ -1 & 10 & -1 \end{bmatrix}$ (2) $\begin{bmatrix} 8 & -1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$ (3) $\begin{bmatrix} 8 & 1 & 2 \\ 1 & 10 & 1 \end{bmatrix}$ **(4) $\begin{bmatrix} \mathbf{8} & \mathbf{1} & \mathbf{2} \\ \mathbf{-1} & \mathbf{10} & \mathbf{-1} \end{bmatrix}$**

$2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$; $A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$

$B = ?$

$2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$ ……… (1)

$A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$ …………. (2)

$(2) \times 2 \Rightarrow \cancel{2A} + 4B = \begin{bmatrix} 10 & 0 & 6 \\ 2 & 12 & 4 \end{bmatrix}$

$(1) \quad \Rightarrow \cancel{2A} + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$

$(-) \quad (-) \quad (-)$

$B = \begin{bmatrix} 8 & 1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$

17. If $\begin{bmatrix} 4 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ -2 \\ x \end{bmatrix} = [6]$ then x is

(1) 4 (2) 3 (3) 2 (4) 1

$\begin{bmatrix} 4 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ -2 \\ x \end{bmatrix} = [6], \; x = ?$

1×3

$3 \times 1 = 1 \times 1$

$4 - 6 + 2x = 6$

$-2 + 2x = 6$

$2x = 6 + 2$

$x = \frac{8}{2} = 4$

18. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}_{3\times2}$, $B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times3}$ then which of the following products can be made from these matrices

(i) A^2 (ii) B^2 (iii) AB (iv) BA

(1) (i) only (2) (ii) and (iii) only

(3) (iii) and (iv) only (4) All the above

$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}_{3\times2}$, $B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times3}$

Only (iii) and (iv) are possible

19. If $A = \begin{bmatrix} y & 0 \\ 3 & 4 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then $A^2 = 16I$ for

(1) $y = 4$ (2) $y = 5$ **(3) $y = -4$** (4) $y = 16$

$A = \begin{bmatrix} y & 0 \\ 3 & 4 \end{bmatrix}, \; I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \; A^2 = 16I, \; y = ?$

$$A^2 = \begin{bmatrix} y & 0 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} y & 0 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} y^2+0 & 0+0 \\ 3y+12 & 0+16 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} y^2 & 0 \\ 3y+12 & 16 \end{bmatrix}$$

$$16I = 16\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 16 & 0 \\ 0 & 16 \end{bmatrix}$$

$$A^2 = 16I$$

$$\begin{bmatrix} y^2 & 0 \\ 3y+12 & 16 \end{bmatrix} = \begin{bmatrix} 16 & 0 \\ 0 & 16 \end{bmatrix}$$

$$3y + 12 = 0$$

$$3y = -12$$

$$y = \frac{-12}{3}$$

$$y = -4$$

20. If P and Q are matrices, then which of the following is true?

(1) $\boldsymbol{PQ \neq QP}$ (2) $(P^T)^T \neq P$ (3) $P + Q \neq Q + P$ (4) All are true

If P and Q are matrices, then $PQ \neq QP$

4. Geometry

1. If triangle PQR is similar to triangle LMN such that $4PQ = LM$ and $QR = 6\ cm$ then MN is equal to

(1) $12\ cm$ **(2) $\boldsymbol{24\ cm}$** (3) $10\ cm$ (4) $36\ cm$

$$4PQ = LM$$

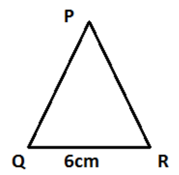
$$PQ = \frac{LM}{4}$$

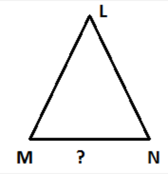
$$\frac{PQ}{LM} = \frac{QR}{MN}$$

$$\frac{LM}{4LM} = \frac{6}{MN}$$

$$MN = 6 \times 4$$

$$MN = 24cm$$

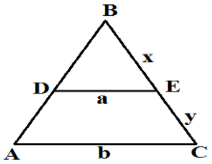




2. In the given figure $DE \parallel AC$ which of the following is

(1) $x = \frac{ay}{b+a}$ (2) $x = \frac{a+b}{ay}$

(3) $\boldsymbol{x = \frac{ay}{b-a}}$ (4) $\frac{x}{y} = \frac{a}{b}$



$\Delta ABC \sim \Delta BDE$ (Similar)

$$\frac{BE}{BC} = \frac{DE}{AC}$$

$$\frac{x}{a} = \frac{x+y}{b}$$

$$bx = ax + ay$$

$$bx - ax = ay$$

$$x(b-a) = ay$$

$$x = \frac{ay}{b-a}$$

3. S and T are points on sides PQ and PR respectively of ΔPQR. If $PS = 3cm,\ SQ = 6cm,$ $PT = 5cm$ and $TR = 10cm$ then QR

(1) $4ST$ (2) $5ST$ **(3) $3ST$** (4) $3QR$

$$\Delta PST \sim \Delta PQR$$

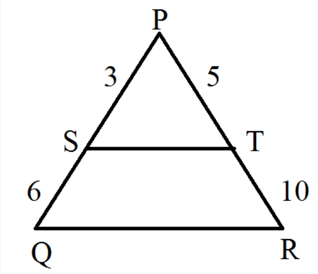
$$\frac{PS}{PQ} = \frac{PT}{PR} = \frac{ST}{QR}$$

$$\frac{3}{9} = \frac{5}{15} = \frac{ST}{QR}$$

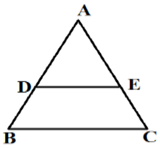
$$\frac{ST}{QR} = \frac{5}{15}$$

$$ST \times 3 = QR$$

$$QR = 3ST$$



4. In figure $DE \parallel BC$, if $BD = x-3, BA = 2x, CE = x-2$ and $AC = 2x+3$. Find the value of x.

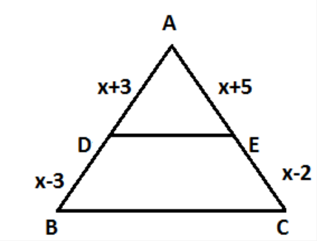


(1) 3 (2) 6

(3) 9 (4) 12

$$AD = AB - BD$$
$$= 2x - (x-3)$$
$$= 2x - x + 3$$
$$AD = x + 3$$

$$AE = AC - EC$$
$$= 2x + 3 - (x-2)$$
$$= 2x + 3 - x + 2$$
$$AE = x + 5$$



$$\frac{AD}{DB} = \frac{AE}{EC}$$

$$\frac{x+3}{x-3} = \frac{x+5}{x-2}$$

$$(x+3)(x-2) = (x+5)(x-3)$$

$$x^2 - 2x + 3x - 6 = x^2 - 3x + 5x - 15$$

$$x^2 - x^2 + x - 2x + 15 - 6 = 0$$

$$-x + 9 = 0$$

$$-x = -9$$

$$x = 9$$

5. The ratio of the areas of two similar triangles is equal to

(1) The ratio of their corresponding sides

(2) The cube of the ratio of their corresponding sides

(3) The ratio of their corresponding altitudes

(4) The square of the ratio of their corresponding sides

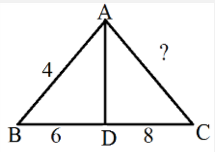
6. If ABC is a triangle and AD bisects $\angle A,\ AB = 4cm, BD = 6cm, DC = 8cm$ then the value of AC is

(1) $\frac{16}{3}$ cm (2) $\frac{32}{3}$ cm (3) $\frac{3}{16}$ cm (4) $\frac{1}{2}$ cm

$$\frac{AB}{AC} = \frac{BD}{DC}$$

$$\frac{4}{AC} = \frac{6}{8} \Rightarrow 3AC = 16$$

$$AC = \frac{16}{3} cm$$



7. In a triangle, the internal bisector of an angle bisects the opposite side. Find the nature of the triangle.
(1) right angle (2) equilateral (3) scalene **(4) isosceles**

8. The height of an equilateral triangle of side a is
(1) $\frac{a}{2}$ (2) $\sqrt{3}a$ **(3) $\frac{\sqrt{3}}{2}a$** (4) $\frac{\sqrt{3}}{4}\ a$

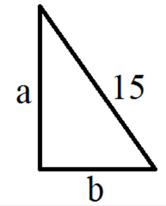
9. The perimeter of right triangle is 40 cm. Its hypotenuse is 15 cm, then the area of the triangle is
(1) 100 cm^2 (2) 200 cm^2 (3) 160 cm^2 (4) 225 cm^2

The perimeter of triangle is 40cm its hypotenuse is 15 cm then the area of the triangle is

$$a + b + c = 40$$
$$a + b = 40 - 15$$
$$a + b = 25$$

By using Pythagoras theorem,

$$a^2 + b^2 = 15^2$$
$$(a + b)^2 - 2ab = 225$$
$$25^2 - 2ab = 225$$
$$2ab = 625 - 225$$
$$2ab = 400$$
$$ab = 200$$
$$\therefore \textit{the area of } \Delta = \frac{1}{2}bh$$
$$= \frac{1}{2}ab$$
$$= \frac{1}{2}(200)$$
$$= 100\ cm^2$$

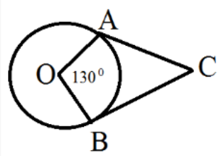


10. A line which intersects a circle at two distinct points is called
(1) Point of contact **(2) secant** (3) diameter (4) tangent

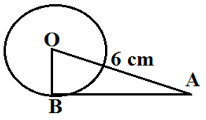
11. If the angle between two radii of a circle is 130°, the angle between the tangents at the end of the radii is
(1) 50° (2) 90°
(3) 40° (4) 70°

In quadrilateral OABC

$$\angle A + \angle B + \angle C + \angle O = 360°$$
$$90° + 90° + \angle C + 130° = 360°$$
$$\angle C = 360° - 310°$$
$$\angle C = 50°$$



12. In figure $\angle OAB = 60°$ and $OA = 6\ cm$ then radius of the circle is



(1) $\frac{3}{2}\sqrt{3}\ cm$ (2) $2\ cm$

(3) $3\sqrt{3}\ cm$ (4) $2\sqrt{3}\ cm$

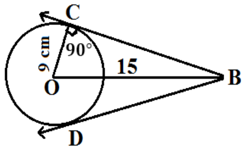
$30^0 : 60^0 : 90^0 \Rightarrow 1 : \sqrt{3} : 2$

$2\ \text{part}\ = 6cm$

$1\ \text{part}\ = \frac{6}{2} = 3cm$

Thus the radius $= 3\sqrt{3}cm$

13. In the given figure if $OC = 9cm$ and $OB = 15\ cm$ then $OB + BD$ is equal to



(1) $23\ cm$ (2) $24\ cm$

(3) $27\ cm$ (4) $30\ cm$

$BC = BD$

$BD = \sqrt{15^2 - 9^2}$

$= \sqrt{225 - 81} = \sqrt{144}$

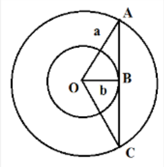
$BD = 12cm$

$OB + BD = 15 + 12 = 27cm$

14. Two concentric circles of radii a and b where $a > b$ are given. The length of the chord of the larger circle which touches the smaller circle is

(1) $\sqrt{a^2 - b^2}$ **(2) $2\sqrt{a^2 - b^2}$** (3) $\sqrt{a^2 + b^2}$ (4) $2\sqrt{a^2 + b^2}$

$r_1 = b, r_2 = a, a > b$



In ΔOAB

$\angle B = 90^0$

$AB = \sqrt{a^2 - b^2}$ (By Pythagoras theorem)

The length of the chord $AC = 2AB = 2\sqrt{a^2 - b^2}$

15. Three circles are drawn with the vertices of a triangle as centres such that each circle touches the other two if the sides of the triangle are 3 cm and 4 cm. Find the diameter of the smallest circle.

(1) $1\ cm$ (2) $3\ cm$ (3) $5\ cm$ (4) $4\ cm$

$x + y = 2$............ (1)

$y + z = 4$............ (2)

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

$(1) + (2) + (3)$

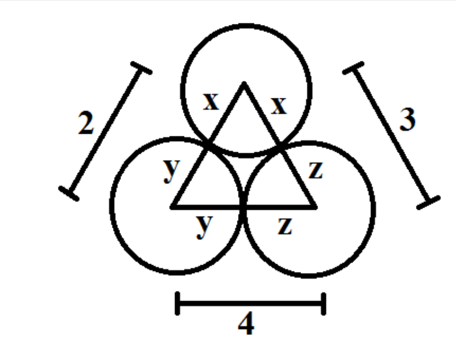
$2x + 2y + 2z = 9$

$x + y + z = \frac{9}{2}$

$2 + z = \frac{9}{2}$

$z = \frac{9}{2} - 2$

$z = \frac{5}{2} = 2.5$



$\therefore z = 2.5$

$x = 3 - 2.5 = 0.5$

$y = 4 - 2.5 = 1.5$

$x = 0.5$ then

Diameter$= 0.5 \times 2 \ = 1.0$

$= 1cm$

5. Coordinate Geometry

1. Find the ratio in which the line segment joining the points $(-3, 10)$and$(6, -8)$is internally divided by $(-1,6)$

(1) 7:2 (2) 3:4 **(3) 2:7** (4) 5:3

$(-3,10), (6,-8), m\!:n =?$

$\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right) = (-1,6)$

$\frac{m(6)+n(-3)}{m+n} = -1; \frac{m(-8)+n(10)}{m+n} = 6$

$6m - 3n = -m - n$

$6m + m = -n + 3n$

$7m = 2n$

$\frac{m}{n} = \frac{2}{7}$

$m\!:n = 2\!:7$

2. If the points $(0,0), (a, 0)$ and $(0, b)$ are collinear then

(1) $a = b$ (2) $a + b = 0$ **(3) $\boldsymbol{ab = 0}$** (4) $a \neq b$

If the points $(0,0), (a, 0)$and $(0, b)$are collinear then

$\frac{1}{2}\begin{Bmatrix} 0 & a & 0 & 0 \\ 0 & 0 & b & 0 \end{Bmatrix} = 0$

$\frac{1}{2}\{0 + ab + 0\} - \{0 + 0 + 0\} = 0$

$\frac{1}{2}\{ab\} = 0$

$ab = 0$

3. If the mid-point of the line segment joining $A\left(\frac{x}{2}, \frac{y+1}{2}\right)$ and $B(x + 1, y - 3)$ is $C(5, -2)$ then find the values of x, y

(1) (6, −1) (2) (−6,1) (3) (−2,1) (4) (3,5)

$A\left(\frac{x}{2}, \frac{y+1}{2}\right), B(x + 1, y - 3), M = C(5, -2)$ mid-point $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$\left(\frac{\frac{x}{2}+(x+1)}{2}, \frac{\frac{y+1}{2}+(y-3)}{2}\right) = (5, -2)$

$\left(\frac{\frac{x+2x+2}{2}}{2}, \frac{\frac{y+1+2y-6}{2}}{2}\right) = (5, -2)$

$\left(\frac{3x+2}{4}, \frac{3y-5}{4}\right) = (5, -2)$

$\frac{3x+2}{4} = 5 \qquad \frac{3y-5}{4} = -2$

$3x + 2 = 20 \qquad 3y - 5 = -8$

$3x = 20 - 2 \qquad 3y = -8 + 5$

$3x = 18 \qquad 3y = -3$

$x = \frac{18}{3} = 6 \quad y = -\frac{3}{3} = -1$

$x = 6 \qquad y = -1$

$\therefore\ (x, y) = (6, -1)$

4. The area of triangle formed by the points $(a, b+c), (b, c+a)$ and $(c, a+b)$ is

(1) $a+b+c$ (2) abc (3) $(a+b+c)^2$ **(4) 0**

$(a, b+c), (b, c+a)(c, a+b); A = ?$

$$A = \frac{1}{2}\left\{\begin{array}{cccc} a & b & c & a \\ b+c & c+a & a+b & b+c \end{array}\right\}$$

$= \frac{1}{2}\{(ac + a^2 + ab + b^2 + bc + c^2) - (b^2 + bc + c^2 + ac + a^2 + ab)\}$

$= \frac{1}{2}\{a^2 + b^2 + c^2 + ab + bc + ac - a^2 - b^2 - c^2 - ab - bc - ac\}$

$= \frac{1}{2}(0)$

$= 0$

5. The four vertices of a quadrilateral are $(1,2), (-5,6), (7,-4)$ and $(k,-2)$ taken in order. If the area of quadrilateral is zero then find the value of .

(1) -4 (2) -2 (3) 6 **(4) 3**

$A(1,2), B(-5,6), C(7,-4), D(k,-2), k = ?$

$$A = \frac{1}{2}\left\{\begin{array}{ccccc} 1 & -5 & 7 & k & 1 \\ 2 & 6 & -4 & -2 & 2 \end{array}\right\} = 0$$

$\Rightarrow \frac{1}{2}\{(6 + 20 - 14 + 2k) - (-10 + 42 - 4k - 2)\} = 0$

$\frac{1}{2}\{(12 + 2k) - ((30 - 4k)\} = 0$

$\frac{1}{2}\{6k - 18\} = 0$

$6k - 18 = 0$

$6k = 18$

$k = \frac{18}{6};$

$k = 3$

6. Find the equation of the line passing through the point $(5,3)$ which is parallel to the y axis is

(1) $y = 5$ (2) $y = 3$ **(3) $x = 5$** (4) $x = 3$

The equation of the line passing through the point $(5,3)$which is parallel to the y axis is $x = 5$

7. Find the slope of the line $2y = x + 8$

(1) $\frac{1}{2}$ (2) 1 (3) 8 (4) 2

$x - 2y - 8 = 0$

$\text{slope} = \frac{-\text{coefficient of } x}{\text{coefficient of } y} = \frac{-1}{-2} = \frac{1}{2}$

8. Find the value of , given that the line $\frac{y}{2} = x - p$ passes through the point $(-4,4)$ is

(1) -4 **(2) -6** (3) 0 (4) 8

$\frac{y}{2} = x - p, (-4,4), \ p \ = ?$

$x = -4, y = 4$ then $\frac{4}{2} = -4 - p$

$2 = -4 - p$

$2 + 4 = -p$

$p = -6$

9. Find the slope and the y -intercept of the line $3y - \sqrt{3}x + 1 = 0$ is

(1) $\boldsymbol{\frac{1}{\sqrt{3}}, -\frac{1}{3}}$ (2) $-\frac{1}{\sqrt{3}}, -\frac{1}{3}$ (3) $\sqrt{3}, 1$ (4) $-\sqrt{3}, 3$

$3y - \sqrt{3}x + 1 = 0$, slope and the y -intercept =?

$$\text{slope} = \frac{-\text{ coefficient of } x}{\text{coefficient of } y}$$

$$= \frac{-(-\sqrt{3})}{3}$$

$$= \frac{\sqrt{3}}{3} = \frac{\sqrt{3}}{\sqrt{3}\times\sqrt{3}}$$

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

$$y\text{ -intercept } = \frac{-\text{ constant}}{\text{coefficient of } y} = \frac{-1}{3}$$

10. The lines $y = 5x - 3, y = 2x + 9$ intersect at A. The coordinates of A are

(1) (2,7) (2) (2,3) **(3) $\boldsymbol{(4, 17)}$** (4) $(-4, 23)$

$y = 5x - 3, y = 2x + 9$

$0 = 5x - y - 3$ $x = \frac{12}{3}$

$5x - \cancel{y} = 3$......... (1)

$2x - \cancel{y} = -9$....... (2)

(−) (+) (+)

$3x \quad = 12 \qquad \Rightarrow x = 4$

Sub $x = 4$ in (1)

$5x - y = 3$

$5(4) - y = 3$

$20 - y = 3 \quad \Rightarrow \quad -y = 3 - 20 \quad \Rightarrow \quad -y = 17$

$y = 17$

∴The coordinates of A are(4,17)

11. Find the value of 'a' if the lines $7y = ax + 4$ and $2y = 3 - x$ are parallel.

(1) $a = \frac{7}{2}$ (2) $a = -\frac{2}{7}$ (3) $a = \frac{2}{7}$ **(4) $\boldsymbol{a = -\frac{7}{2}}$**

$7y = ax + 4,\ \ 2y = 3 - x$ Slopes are equal

$ax - 7y + 4 = 0$

$x + 2y - 3 = 0$

$$\text{Slope } m = \frac{-\text{ co−efficient of } x}{\text{co−efficient of } y};$$

$$m_2 = \frac{-1}{2}$$

$$m_1 = \frac{-a}{-7} = \frac{a}{7}$$

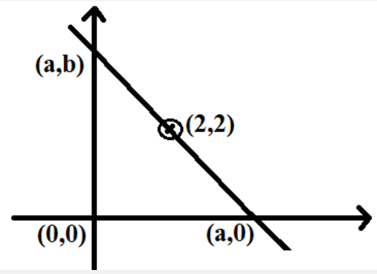
$$m_1 = m_2 \Rightarrow \frac{a}{7} = \frac{-1}{2} \Rightarrow \ \ 2a = -7 \ \ \Rightarrow \ a = -\frac{7}{2}$$

12. A line passing through the point (2,2) and the axes enclose an area α. The intercepts on the axes made by the line are given by the roots of

(1) $x^2 - 2\alpha x + \alpha = 0$ (2) $x^2 + 2\alpha x + 2\alpha = 0$

(3) $x^2 - \alpha x + 2\alpha = 0$ (4) none of these

Area of the triangle $= \frac{1}{2}\begin{bmatrix} a & 0 & 0 & a \\ 0 & 0 & b & 0 \end{bmatrix}$



$$\alpha = \frac{1}{2}[(0+0+0)-(0+0+ab)]$$

$$\alpha = \frac{1}{2}\ [0-ab]$$

$$\alpha = \frac{1ab}{2} \Rightarrow \quad ab = 2\alpha$$

Three points are in collinear $(a,0)(2,2)(0,b)$

$$\frac{1}{2}\begin{Bmatrix} a & 0 & 0 & a \\ 0 & 0 & b & 0 \end{Bmatrix} = 0$$

$$\frac{1}{2}[(2a+2b+)-(0+0+ab)] = 0$$

$$\frac{1}{2}[2(a+b)-ab] = 0$$

$$\frac{1}{2}[2(a+b)-2\alpha] = 0 \qquad [\because ab = 2\alpha]$$

$$\frac{1}{2}\ 2[(a+b)-\alpha] = 0$$

$$a+b = \alpha$$

General form of quadratic equation $x^2-(a+b)x+ab = 0$

$$x^2 - \alpha x + 2\alpha = 0$$

13. Find the equation of the line passing through the point $(0,4)$ and is parallel to the line $3x+5y+15=0$ is

(1) $3x+5y+15=0$ **(2) $3x+5y-20=0$**

(3) $2x+7y-20=0$ (4) $4x+3y-15=0$

The line parallel to the line $3x+5y+15=0$ is $3x+5y+k=0$

$\therefore$ $3x+5y+k=0$ is passing through the point $(0,4)$

$$3(0)+5(4)+k=0$$

$$0+20+k=0$$

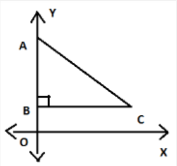
$$k=-20$$

$$\therefore 3x+5y-20=0$$

14. In a right angled triangle , right angled at B , if the side BC is parallel to x axis, then the slope of AB is

(1) $\sqrt{3}$ (2)$\frac{1}{\sqrt{3}}$ (3) 1 **(4) not defined**

In a right angled triangle ABC , $\angle B = 90^0$, if the side BC is parallel to x axis, then the slope of AB is not defined



15. The y-intercept of the line $3x-4y+8=0$ is

(1) $-\frac{8}{3}$ (2) $\frac{3}{8}$ **(3) 2** (4) $\frac{1}{2}$

y-intercept of the line $3x-4y+8=0$ is $= \frac{-\text{constant}}{\text{co-efficient of } y} = \frac{-8}{-4} = 2$

$$3x-4y=-8$$

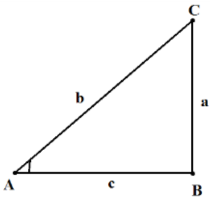
Divide '-8' on both side $\frac{3x}{-8} - \frac{4y}{-8} = \frac{-8}{-8}$

$$\frac{x}{-8/3}+\frac{y}{8/4}=1$$

$$\frac{x}{-8/3}+\frac{y}{2}=1 \quad \text{compare with } \frac{x}{a}+\frac{y}{b}=1$$

$b = \ y\ -$ intercept $= 2$

6. Trigonometry



1. From the figure, the value of $cosec\,\theta+\cot\theta$ is

(1) $\frac{a+b}{c}$ (2) $\frac{c}{a+b}$

(3) $\boldsymbol{\frac{b+c}{a}}$ (4) $\frac{b}{a+c}$

$$cosec\,\theta+\cot\theta=\frac{\text{Hypotenuse}}{\text{Opposite side}}+\frac{\text{Adjacent side}}{\text{Opposite side}}$$

$$=\frac{b}{a}+\frac{c}{a}$$

$$=\frac{b+c}{a}$$

2. $(\sec A+\tan A)\,(1-\sin A)$ is equal to

(1) $\sec A$ (2) $\sin A$

(3) $cosec\ A$ **(4) $\boldsymbol{\cos A}$**

$$(sec\ A+tan\ A)(1-sin\ A)=\sec A-\sec A\sin A+\tan A-\tan A\,.\sin A$$

$$=\sec A-\frac{1}{\cos A}.\sin A+\tan A-\frac{\sin A}{\cos A}.\sin A$$

$$=\sec A-\frac{\sin A}{\cos A}+\tan A-\frac{\sin^2 A}{\cos A}$$

$$=\sec A-\tan A+\tan A-\frac{\sin^2 A}{\cos A}$$

$$=\frac{\sec A.\cos A-\sin^2 A}{\cos A}$$

$$=\frac{\frac{1}{\cos A}.\cos A-\sin^2 A}{\cos A}$$

$$=\frac{1-\sin^2 A}{\cos A}$$

$$=\frac{\cos^2 A}{\cos A}$$

$$=\cos A$$

3. If $X=r\sin\theta\cos\phi\,,\ y=r\sin\theta\sin\phi$ and $z=r\cos\theta$ Then, $X^2+Y^2+Z^2$ is equal to

(1) r **(2) $\boldsymbol{r^2}$** (3) $\frac{r^2}{2}$ (4) $2r^2$

$x=r\sin\theta\cos\phi\,, y=r\sin\theta\sin\phi$ and $z=r\cos\theta$

$$x^2+y^2+z^2=r^2\sin^2\theta\cos^2\phi+r^2\sin^2\theta\sin^2\phi+r^2\cos^2\theta$$

$$=r^2\sin^2\theta[\cos^2\phi+\sin^2\phi]+r^2\cos^2\theta$$

$$= r^2\sin^2\theta + r^2\cos^2\theta$$
$$= r^2[\sin^2\theta + \cos^2\theta]$$
$$= r^2$$

4. If $\cos\theta + \cos^2\theta = 1$ then $\sin^2\theta + \sin^4\theta$ is equal to

(1) 1 (2) 0 (3) -1 (4) none of these

$$\cos\theta + \cos^2\theta = 1$$
$$\cos\theta = 1 - \cos^2\theta$$
$$\cos\theta = \sin^2\theta$$
$$\sin^4\theta = \sin^2\theta\sin^2\theta$$
$$= \cos\theta\ \cos\theta$$
$$= \cos^2\theta$$

Then, $\sin^2\theta + \sin^4\theta = \cos\theta + \cos^2\theta = 1$

5. If $\tan\theta + \cot\theta = 3$ then $\tan^2\theta + \cot^2\theta$ is equal to

(1) 4 **(2) 7** (3) 6 (4) 9

Given $\tan\theta + \cot\theta = 3$

Squaring on both side

$$(\tan\theta + \cot\theta)^2 = 3^2$$
$$\tan^2\theta + \cot^2\theta + 2\tan\theta\cot\theta = 9$$
$$\tan^2\theta + \cot^2\theta + 2(1) = 9$$
$$\tan^2\theta + \cot^2\theta + 2 = 9$$
$$\tan^2\theta + \cot^2\theta = 9 - 2$$
$$\tan^2\theta + \cot^2\theta = 7$$

6. If $m\cos\theta + n\sin\theta = a$ and $m\sin\theta - n\cos\theta = b$ then $a^2 + b^2$ is equal to

(1) $m^2 - n^2$ **(2) $\boldsymbol{m^2 + n^2}$** (3) m^2n^2 (4) $n^2 - m^2$

$$a^2 + b^2 = (mcos\,\theta + nsin\theta)^2 + (msin\theta - ncos\,\theta)^2$$
$$= m^2cos^2\theta + n^2sin^2\theta + 2mncos\theta.sin\theta + m^2sin^2\theta + n^2cos^2\theta - 2mnsin\theta - cos\theta$$
$$= m^2(sin^2\theta + cos^2\theta) + n^2(sin^2\theta + cos^2\theta)$$
$$= m^2(1) + n^2(1)$$
$$= m^2 + n^2$$

7. $\frac{\tan\theta}{\sec\theta-1} + \frac{\tan\theta}{\sec\theta+1}$ is equal to

(1) $2\tan\theta$ (2) $2\sec\theta$ **(3) $\boldsymbol{2\ cosec\ \theta}$** (4) $2\tan\theta\sec\theta$

$$\frac{tan\ \theta}{sec\theta-1} + \frac{tan\theta}{sec\theta+1} = \frac{tan\theta(sec\theta+1)+tan\theta(sec\theta-1)}{(sec\theta-1)(sec\theta+1)}$$
$$= \frac{tan\theta.sec\theta+tan\theta+tan\theta.sec\theta-tan\theta}{\sec^2\theta-1}$$
$$= \frac{2tan\theta.sec\theta}{\sec^2\theta-1}$$
$$= \frac{2\frac{sin\theta}{cos\theta}.\frac{1}{cos\theta}}{tan\theta}$$

$$= \frac{2tan\theta.\frac{1}{cos\theta}}{tan\theta}$$
$$= 2 \times \frac{1}{cos\theta}$$
$$= 2cosec\theta$$

8. The value of $\left(\frac{3}{\cot^2\theta} - \frac{3}{\cos^2\theta}\right)$ is equal to

(1) $\frac{1}{3}$ (2) 3 (3) 0 **(4) -3**

$$\frac{\mathbf{3}}{\mathbf{cot^2}\,\boldsymbol{\theta}} - \frac{\mathbf{3}}{\mathbf{cos^2}\,\boldsymbol{\theta}} = \frac{3}{\frac{\cos^2\theta}{\sin^2\theta}} - \frac{3}{\cos^2\theta}$$
$$= \frac{3\sin^2\theta}{\cos^2\theta} - \frac{3}{\cos^2\theta}$$
$$= \frac{3\sin^2\theta - 3}{\cos^2\theta}$$
$$= \frac{3(\sin^2\theta - 1)}{\cos^2\theta}$$
$$= \frac{-3(1-\sin^2\theta)}{\cos^2\theta}$$
$$= \frac{-3(\cos^2\theta)}{\cos^2\theta}$$
$$= -3$$

9. If $\sin(\alpha + \beta) = 1$, then $\cos(\alpha - \beta)$ can be reduced to

(1) $\sin\alpha$ (2) $\cos\beta$ **(3) $\sin 2\beta$** (4) $\cos 2\beta$

$\sin(\alpha + \beta) = 1$

$\sin 90 = 1$

$\alpha + \beta = 1$

$\alpha + \beta = 90$

$\alpha = 90 - \beta$ is substitute in $\cos(\alpha - \beta)$

$\cos(\alpha - \beta) = \cos(90 - \beta - \beta)$

$= \cos(90 - 2\beta)$ $[\because \cos(90 - \theta) = \sin\theta]$

$= \sin 2\beta$

10. If $X = a\sec\theta$ and $Y = b\tan\theta$, then $b^2X^2 - a^2Y^2$ is equal to

(1) ab (2) $a^2 - b^2$ (3) $a^2 + b^2$ **(4) a^2b^2**

$x^2 = a^2sec^2\theta, y^2 = b^2tan^2\theta$

LHS

$b^2x^2 - a^2y^2 = b^2(a^2sec^2\theta) - a^2(b^2tan^2\theta)$

$= a^2b^2(\sec^2\theta - tan^2\theta)$

$= a^2b^2(1)$

$= a^2b^2$

11. The angle of elevation of the top of tree from a point at a distance of 250 m from its base is 60°. The heights of the tree is

(1) 250 m **(2) 250 $\sqrt{3}$ m** (3) $\frac{250}{\sqrt{3}}$ m (4) 200 $\sqrt{3}$ m

In ΔBAC, $\angle A = 60^0 \angle A = 250$m

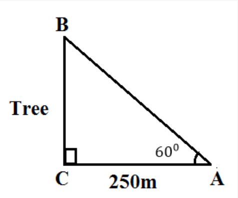
$\tan 60^0 = \frac{BC}{CA}$

$\sqrt{3} = \frac{BC}{250}$

$\Rightarrow 250\sqrt{3} = BC$

$BC = 250 \times \sqrt{3}$m

Height of the tree $= 250\sqrt{3}$m



12. The angle of depression of a boat from a $50\sqrt{3}\ m$ high bridge is 30°. The horizontal distance of the boat from the bridge is

(1) 150 m
(2) $150\sqrt{3}\ m$
(3) $60\ m$
(4) $60\sqrt{3}\ m$

bridge height =AB , C= boat

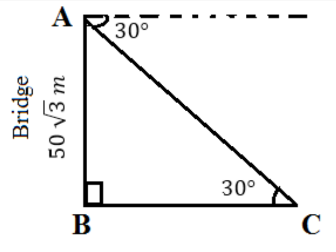
$\tan 30^\circ = \frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{50\sqrt{3}}{BC}$

$BC = 50\sqrt{3} \times \sqrt{3}$

$= 50 \times 3$

$BC = 150$m



13. A Ladder of length 14 m just reaches the top of a wall. If the ladder makes an angle of 60° with the horizontal, then the height of the wall is

(1) $14\sqrt{3}\ m$
(2) $28\sqrt{3}\ m$
(3) $7\sqrt{3}\ m$
(4) $35\sqrt{3}\ m$

AC = Ladder = 14 m

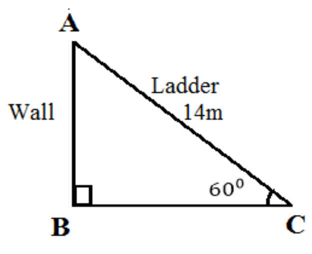
Height of the wall $\sin 60^\circ = \frac{AB}{AC}$

$\frac{\sqrt{3}}{2} = \frac{AB}{14}$

$14\sqrt{3} = 2AB$

$\frac{14\sqrt{3}}{2} = AB$

$AB = 7\sqrt{3}$ m



14. The top of two poles of height 18.5 m and 7 m are connected by a wire. If the wire makes an angle of measure 30° with horizontal, then the length of the wire is

(1) 23 m
(2) 18 m
(3) 28 m
(4) 25.5 m

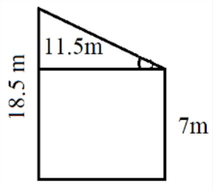
Length of the wire x

$\sin 30^\circ = \frac{\text{opposite side}}{\text{Hyp}} = \frac{11.5}{x}$

$\frac{1}{2} = \frac{11.5}{x}$

$x = 2 \times 11.5$

$x = 23m$



15. The banks of a river are parallel. A swimmer starts from a point on one of the banks and swims in a straight line inclined to the bank at 45° and reaches the opposite bank at a point 20 m, from the point opposite to the starting point. The breadth of the river is equal to $(\sqrt{2} = 1.414)$

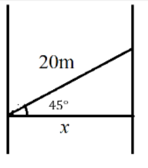
(1) $12.12\ m$ **(2) $14.14\ m$** (3) $16.16\ m$ (4) $18.18\ m$

Breath of the river is x

$\cos 45^0 = \frac{x}{20} \Rightarrow \quad \frac{1}{\sqrt{2}} = \frac{x}{20} \Rightarrow \quad \frac{20}{\sqrt{2}} = x \Rightarrow \quad \frac{2\times10}{\sqrt{2}} = x$

$x = 1.414 \times 10$

$x = 14.14\ m$



7. Mensuration

1. The curved surface area of a right circular cone of height 15 cm and base diameter 16 cm is

(1) $60\ \pi\ cm^2$ (2) $66\pi\ cm^2$ (3) $120\pi\ cm^2$ **(4) $136\pi\ cm^2$**

$15cm = h,\ d = 16cm$

$l = \sqrt{15^2 + 8^2}$

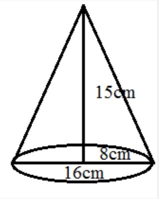
$= \sqrt{225 + 64} = \sqrt{289}$

$= 17cm$

The curved surface area of a right circular cone $= \pi rl$

$= \pi \times 8 \times 17$

$= 136\pi\ cm^2$



2. If S_1 denotes the total surface area of a sphere of radius r and S_2 denotes the total surface area of a cylinder of base radius r and height $2r$, then

(1) $S_1 = S_2$ (2) $S_1 > S_2$ **(3) $S_1 < S_2$** (4) $S_1 = 2S_2$

$r =$ radius , $4\pi r^2 = S$

radius $= r,\ h = 2r,\ 2\pi r(h + r) = S_2$

$2\pi r(2r + r) = S_2$

$3r(2\pi r) = 6\pi r^2 = S_2$

$\therefore S_1 < S_2$

3. The ratio of the volumes of two spheres is $8: 27$. If r and R are the radii of spheres respectively, then $(R - r): r$ is

(1) $1: 2$ (2) $1: 3$ **(3) $2: 3$** (4) $4: 9$

$V_1: V_2 = 8: 27, r: R = (R - r): r$

$\frac{4}{3}\pi r_1^3 : \frac{4}{3}\pi r_2^3 = 8: 27$

The ratio of the volumes of two spheres is $V_1: V_2$

$\frac{4}{3}\pi(R - r)^3 : \frac{4}{3}\pi r^3 = 8: 27$

$r^3 = 27; r = 3$

$(R - r)^3 = 8$

$(R - r)^3 = 2^3$

$\Rightarrow R - r = 2$

$R - 3 = 2$ $[\because r = 3]$

$R = 2 + 3$

$R = 5$

$(R - r): r \Rightarrow (5 - 3): 3$

The ratio of the volumes of two spheres is $2: 3$

4. The radius of a wire is decreased to one-third of the original. If volume remains the same, then the length will be increased _______ of the original.

(1) 3 times (2) 6 times **(3) 9 times** (4) 27 times

$\pi r^2 h = \pi r^2 h$

$\pi r^2 h = \pi \left(\frac{1}{3}r\right)^2 h \qquad (\because r \to \frac{1}{3}r)$

$r^2 h = \frac{1}{9} r^2 h$

$h = \frac{1}{9} h$

$9h = h$

9 times

5. The height of a cone is 60 *cm*. A small cone is cut off at the top by a plane parallel to the base and its volume is $\left(\frac{1}{64}\right)^{th}$ the volume the original cone. The height of the smaller cone is

(1) 45 *cm* (2) 30 *cm* **(3) 15 *cm*** (4) 20 *cm*

Volume of the large cone $= \frac{1}{3}\pi R^2 H$

$\frac{h}{r} = \frac{60}{R}$

$r = \frac{hR}{60}$

Volume of smaller cone $= \left(\frac{1}{64}\right)$(Volume of large cone)

$$\frac{1}{3}\pi r^2 h = \frac{1}{64}\left(\frac{1}{3}\pi R^2 H\right)$$

$$\frac{1}{3}\pi \left(\frac{hR}{60}\right)^2 h = \frac{1}{64}\left(\frac{1}{3}\pi R^2 60\right)$$

$$h^3 = \frac{60\times60\times60}{4\times4\times4}$$

$$h = \frac{60}{4} = 15\text{cm}$$

6. A solid frustum is of height 8 *cm*. If the radii of its lower and upper ends are 3 *cm* and 9 *cm* respectively, then its slant height is

(1) 15 *cm* (2) 12 *cm* **(3) 10 *cm*** (4) 17 *cm*

A solid frustum

$l = \sqrt{h^2 + (R_1 - R_2)^2}$

$= \sqrt{8^2 + (9-3)^2} = \sqrt{64 + 6^2} = \sqrt{64 + 36} = \sqrt{100}$

$l = 10$ cm

7. A solid is hemispherical at the bottom and conical above. If the curved surface areas of the two parts are equal, then the ratio of its radius and the height of its conical part is

(1) $1:3$ **(2) $1:\sqrt{3}$** (3) $1:1$ (4) $\sqrt{3}:1$

CSA of a cone = CSA of Hemisphere

$\pi r l : 2\pi r^2$

$l = 2r$

$h = \sqrt{(2r)^2 - r^2}$

$= \sqrt{4r^2 - r^2}$

$= \sqrt{3r^2} = \sqrt{3}r$

$r:\sqrt{3}r$

The ratio of its radius and the height is $1:\sqrt{3}$

8. The material of a cone is converted into the shape of a cylinder of equal radius. If the height of the cylinder is 5 cm, then height of the cone is

(1) 10 cm **(2) 15 cm** (3) 18 cm (4) 24 cm

Volume of the cone = Volume of the cylinder

$\frac{1}{3}\pi r^2 h = \pi r^2 h$

$\frac{1}{3} \times r^2 = r^2 \times 5$

$r = 5 \times 3$

$= 15cm$

9. The curved surface area of a cylinder is 264 m^2 and its volume is 924 m^3. The ratio of diameter to its height is

(1) 3: 7 **(2) 7: 3** (3) 6: 7 (4) 7: 6

CSA = 264 m^2

$2\pi rh = 264$ ....(1)

Volume = $\pi r^2 h = 924$ ....(2)

$\frac{(2)}{(1)} = \frac{\pi r^2 h}{2\pi rh} = \frac{924}{264}$

$\frac{r}{2} = \frac{924}{264}$

$r = \frac{924 \times 2}{264} = 7$

$d = 14\text{m}$

$2\pi rh = 264$

$2 \times \frac{22}{7} \times 7 \times h = 264$

$h = \frac{264}{2 \times 22}$

$h = 6$ m

$d:h = 14:6$

$d:h = 7:3$

10. When Karuna divided surface area of a sphere by the sphere's volume, he got the answer as $\frac{1}{3}$. What is the radius of the sphere?

(1) 24 cm **(2) 9 cm** (3) 54 cm (4) 4.5 cm

$\frac{\text{surface area of a sphere}}{\text{Volume of a sphere}} = \frac{1}{3}$

$\frac{4\pi r^2}{\frac{4}{3}\pi r^3} = \frac{1}{3}$

$= \frac{12}{4r} = \frac{1}{3} \Rightarrow r = 9cm$

11. A spherical steel ball is melted to make 8 new identical balls. Then the radius each new ball is how much times the radius of the original ball?

(1) $\frac{1}{3}$ (2) $\frac{1}{4}$ **(3) $\frac{1}{2}$** (4) $\frac{1}{8}$

Let the radius of the spherical steel ball be 'X'

Then the volume of the spherical steel ball=$\frac{4}{3}\pi r^3$=$\frac{4}{3}\pi X^3$

Let the radius of the small spherical balls be 'x'

Then, Volume=$\frac{4}{3}\pi x^3$

According to the condition

$\frac{4}{3}\pi X^3 = 8[\frac{4}{3}\pi x^3]$

$\frac{4}{3}\pi X^3 = \frac{32}{3}\pi x^3$

$X^3 = 8x^3$

$X = 2x$

Ratio- 1:2

12. A semicircular thin sheet of a metal diameter 28 cm is bent and an open conical cup is made. What is the capacity of the cup?

(1) $\left(\frac{1000}{3}\right)\sqrt{3}\ cm^3$ (2) $300\sqrt{3}\ cm^3$ (3) $\left(\frac{700}{3}\right)\sqrt{3}\ cm^3$ **(4) $\left(\frac{1078}{3}\right)\sqrt{3}\ cm^3$**

Length of the arc is equal to the circumference of the base

$l = \frac{\theta}{360} \times 2\pi r = \frac{180}{360} \times 2 \times \frac{22}{7} \times 14$

$l = 44$

$2\pi r = 44$

$2 \times \frac{22}{7} \times r = 44$

$\frac{44}{7} \times 7 = 44$

$r = \frac{44\times7}{44} = 7$

$h = \sqrt{l^2 - r^2} = \sqrt{14^2 - 7^2} = \sqrt{196 - 49} = \sqrt{147} = 7\sqrt{3}$

Volume of the cone $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7\sqrt{3} = \left(\frac{1078}{3}\right)\sqrt{3}cm^3$

13. A cone of height 9 cm with diameter of its base 18 cm is carved out from a wooden solid sphere of radius 9 cm. The percentage of wood wasted is

(1) 45% (2) 56 % (3) 67% **(4) 75%**

The percentage of wood used $= \frac{Volume\ of\ cone}{Volume\ of\ sphere} \times 100$

$= \frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{4}{3}\pi r_2^3} \times 100$

$= \frac{9\times9\times9}{4\times9\times9\times9} \times 100 = 25\%$

Remaining wood (wasted) % $= 100 - 25 = 75\%$

14. A cylinder having radius 1 m and height 5 m is completely filled with milk. In how many conical flasks can this milk be filled if the flask radius and height is 50 cm each?

(1) 50 (2) 500 **(3) 120** (4) 160

Number of conical flask $= \frac{\text{Volume of cylinder}}{\text{Volume of conical flask}}$

$$= \frac{\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2}$$

$$= \frac{3\times100\times100\times500}{50\times50\times50} = 120$$

15. A floating boat having a length 3 m and breadth 2 m is floating on a lake. The boat sinks by 1 cm when a man gets into it. The mass of the man is (density of water is 1000 kg/m^3)

(1) 50 kg **(2) 60 kg** (3) 70 kg (4) 80 kg

Volume of water by sinking of boat $= lbh$

$$= 3 \times 2 \times \frac{1}{100} = \frac{6}{100} m^3$$

The mass of the man is $= \frac{6}{100} \times 1000 = 60$ kg

8. Statistics and Probability

1. The range of first 10 prime numbers is

(1) 9 (2) 20 **(3) 27** (4) 5

first 10 prime numbers 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

Range $= L - S$

$= 29 - 2$

$= 27$

2. If the smallest value and co-efficient of range of a data are 25 and 0.5 respectively. Then the largest value is

(1) 25 **(2) 75** (3) 100 (4) 12.5

$S = 25$

Range $= 0.25$

Range $= \frac{L-S}{L+S}$

$0.5 = \frac{L-25}{L+25}$

$0.5L + 12.5 = L - 25$

$25 + 12.5 = L - 0.5L$

$37.5 = 0.5L$

$L = \frac{37.5}{0.5} = 75$

3. If the standard deviation of a variable x is 4 and if $y = \frac{3x+5}{4}$, then the standard deviation of y is

(1) 4 (2) 3.5 (3) 3 (4) 2.5

The S.D of $x = 4$

The S.D of $y = \frac{3x+5}{4}$

[If we add or subtract a constant number with each item in the given data, then the S.D doesn't change. In other case we multiply or divide by a constant number with each item in the given data the SD also is multiplied or divided by the constant number]

4. If the observations 1, 2, 3, ... 50 have the variance V_1 and the observations 51, 52, 53, ... 100 have the variance V_2 then $\frac{V_1}{V_2}$ is

(1) 2 **(2) 1** (3) $\frac{1}{2}$ (4) 0

Variance of first 50 natural numbers V_1

Variance of 51, 52, ...100 $= V_2$

$51 = 50 + 1$

$52 = 50 + 2$

...

100=50+50

If we add a constant number with each items in the given data then the variance doesn't change

So $V_1 = V_2$

$\frac{V_1}{V_2} = \frac{V_1}{V_1} = 1$

5. If the data is multiplied by 4, then the corresponding variance is get multiplied by

(1) 4 **(2) 16** (3) 2 (4) None

If the data is multiplied by 4, then the corresponding variance is get multiplied by $4 \times 4 = 4^2 = 16$

6. If the co-efficient of variation and standard deviation of a data are 35% and 7.7 respectively then the mean is

(1) 20 (2) 30 (3) 25 **(4) 22**

C.V $= 35\%$, $\sigma = 7.7$, $\bar{x} = ?$

C.V $= \frac{\sigma}{\bar{x}} \times 100\%$

$35 = \frac{7.7}{\bar{x}} \times 100$

$\bar{x} = \frac{7.7}{35} \times 100$

$\bar{x} = 22$

7. The batsman A is more consistent than batsman B if

(1) C.V of $A >$ C.V of B **(2) C.V of $A <$ C.V of B**

(3) C.V of $A =$ C.V of B (4) C.V of $A \geq$ C.V of B

8. If an event occurs surely, then its probability is

(1) 1 (2) 0 (3) $\frac{1}{2}$ (4) $\frac{3}{4}$

9. A number x is chosen at random from $-4, -3, -2, -1, 0, 1, 2, 3, 4$. The probability that $|X| \leq 3$ is

(1) $\frac{3}{9}$ (2) $\frac{4}{9}$ (3) $\frac{2}{9}$ **(4) $\frac{7}{9}$**

$-4, -3, -2, -1, 0, 1, 2, 3, 4;$

Let A be the event when $|x| \leq 3$

$A = \{-3, -2, -1, 0, 1, 2, 3\}$

$n(A) = 7,$

$P(A) = \frac{n(A)}{n(S)} = \frac{7}{9}$

10. A letter is selected at random from the word 'PROBABILITY'. The Probability that it is not a vowel is

(1) $\frac{4}{11}$ **(2) $\frac{7}{11}$** (3) $\frac{3}{11}$ (4) $\frac{6}{11}$

PROBABILITY

vowel $= O, A, I, I$

$n(S) = 11$

The Probability that it is a vowel $= \frac{4}{11}$

The Probability that it is not a vowel $= 1 - \frac{4}{11}$

$= \frac{11-4}{11}$

$= \frac{7}{11}$

11. In a competition containing two events A and B, the probability of winning the events A and B are $\frac{1}{3}$ and $\frac{1}{4}$ respectively and the probability of winning both the events is $\frac{1}{12}$. The probability of winning only one event is

(1) $\frac{1}{12}$ **(2) $\frac{5}{12}$** (3) $\frac{1}{12}$ (4) $\frac{7}{12}$

In a competition containing two events A and B

The probability of winning the events A $= \mathbf{\frac{1}{3}}$

The probability of winning the events B $= \frac{1}{4}$

The probability of winning both the events $= \frac{1}{12}$

The probability of winning only one event $= P(A \cap \bar{B}) + P(\bar{A} \cap B)$

$= [P(A) - P(A \cap B)] + [P(B) - P(A \cap B)]$

$= \left[\frac{1}{3} - \frac{1}{12}\right] + \left[\frac{1}{4} - \frac{1}{12}\right] = \left[\frac{4-1}{12}\right] + \left[\frac{3-1}{12}\right]$

$= \frac{3}{12} + \frac{2}{12}$

$= \frac{5}{12}$

12. If the probability of non-happening of an events is q, then the probability of happening of the event is

(1) $1 - q$ (2) q (3) $\frac{q}{2}$ (4) $2q$

The probability of non-happening of an events is $= q$

The probability of happening of the events $= 1 - q$

13. When three coins are tossed, the probability of getting the same face on all the three coins is

(1) $\frac{1}{8}$ **(2) $\frac{1}{4}$** (3) $\frac{3}{8}$ (4) $\frac{1}{3}$

$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$

$n(S) = 8$

Let A be the event getting the same face on all the three coins

$A = \{HHH, TTT\}$

$n(A) = 2$

$P(A)=\frac{n(A)}{n(S)}=\frac{2}{8}=\frac{1}{4}$

14. In one thousand lottery tickets, there are 50 prizes to be given. The probability of Mani winning a prize who bought one ticket is

(1) $\frac{1}{50}$ (2) $\frac{1}{100}$ (3) $\frac{1}{1000}$ **(4) $\frac{1}{20}$**

$n(S)=1000$

50 prizes to be given

Let A be the event of Mani winning a prize

$n(A)=50$

$P(A)=\frac{n(A)}{n(S)}=\frac{50}{1000}=\frac{1}{20}$

The probability of Mani winning a prize $=\frac{1}{20}$

15. A box contains some milk chocolates and some coco chocolates and there are 60 chocolates in the box. If the probability of taking a milk chocolate is $\frac{2}{3}$ then the number of coco chocolates is

(1) 40 (2) 50 **(3) 20** (4) 30

Total chocolates = 60

$n(S)=60$

$A\rightarrow$ Milk chocolate, $B\rightarrow$ Coco chocolate

$P(A)=\frac{2}{3}$ $\quad P(B)=?$

$P(A)+P(B)=1$

$\frac{2}{3}+P(B)=1$

$P(B)=1-\frac{2}{3}$

$P(B)=\frac{1}{3}$

$B=60\times\frac{1}{3}$

$=20$