MODEL QUESTION PAPER 2019-2020

MATHEMATICS

X STD

KEY ANSWER

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1) 6
2) 11
3) 8
4) identity function
5) 1
6) 0
7) 4
8) 4
9) 2
9. $\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$
10) $5/11$
11) 12 cm
12) 3.5
13) 33.25

PART-II (Two marks)

14. Define function:-

A relation f between two non-empty sets X and Y is called a from X to Y if, for each $x \in X$ there exists only one $y \in Y$

X மற்றும் Y என்ற வெற்றிடமற்ற கணங்களுக்கு இடையேயான ஒரு உறவு f-ஆனது ஒவ்வொரு $x \in X$ க்கும் ஒரே ஒரு $y \in Y$ இணைக்கிறது எனில் f ஒரு சார்பு எனப்படும்

15 Compute x such that $10^4 \equiv x \pmod{19}$

$10^4 \equiv x \pmod{19}$ என்றவாறு அமையும் x -ன் மதிப்பு?

Solution:

$10^2 = 100 \equiv 5 \pmod{19}$ (மட்டு 19) (2)

$10^4 = (10^2)^2 \equiv 5^2 \pmod{19}$ (மட்டு 19)

$10^4 \equiv 25 \pmod{19}$ (மட்டு 19)

$10^4 \equiv 6 \pmod{19}$ (மட்டு 19)

(since $25 \equiv 6 \pmod{19}$) ஏனெனில் $25 \equiv 6$ (மட்டு 19)

$\boxed{x = 6}$ $\boxed{x \text{-ன் மதிப்பு} = 6}$

16. Simplify (சுருக்குக) $\frac{4x^2y}{2z^2} \times \frac{6xz^3}{20y^4}$

Solution - தீர்வு

$$\Rightarrow \frac{\cancel{4}x^2\cancel{y}}{\cancel{2}\cancel{z^2}} \times \frac{\overset{3}{\cancel{6}}x\cancel{z^3}^{1}}{\underset{5}{\cancel{20}}\cancel{y^4}_{3}}$$

$$= \frac{3x^3z}{5y^3}$$

$\boxed{\text{Solution தீர்வு} = \frac{3x^3z}{5y^3}}$

17. Pari:

time required to complete the work = 4

In 1 hr he will complete = $\frac{1}{4}W$

Yuvan

time required to complete the coork = 6 hrs

In 1 hr he will complete = $\frac{1}{6}W$

working together $\frac{W}{4} + \frac{W}{6}$

$= \frac{6W + 4W}{24} = \frac{5}{12}$

Total coork = $\frac{5}{5/12}W$ = 2.4 hrs.

(18) Find the value of x, y, z

$$\begin{pmatrix} 12 & 3 \\ x & 3/2 \end{pmatrix} = \begin{pmatrix} y & z \\ 3 & 5 \end{pmatrix}$$

(3)

$x = 3$

$y = 12$

$z = 3$

(19) Let x be the length of the ladder

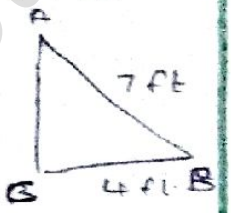
BC = 4 ft AC = 7 ft

By Pythagoras theorem BC = 4 ft AC = 7 ft

$AB^2 = AC^2 + BC^2$ (பிதாகரஸ் தேற்றம்)

$= 7^2 + 4^2$

$x^2 = 49 + 16 = 65$ $\quad x = \sqrt{65}$



The number $\sqrt{65}$ is between 8 and 8.1

(20) Prove that $\sqrt{\frac{1+\cos\theta}{1-\cos\theta}} = \operatorname{cosec}\theta + \cot\theta$

L.H.S $= \sqrt{\frac{1+\cos\theta}{1-\cos\theta} \times \frac{1+\cos\theta}{1+\cos\theta}} = \sqrt{\frac{(1+\cos\theta)^2}{1-\cos^2\theta}}$

$= \sqrt{\frac{(1+\cos\theta)^2}{\sin^2\theta}} = \frac{1+\cos\theta}{\sin\theta} = \frac{1}{\sin\theta} + \frac{\cos\theta}{\sin\theta}$

$= \operatorname{cosec}\theta + \cot\theta = R.H.S$

(21) Surface area of sphere $A = 4\pi r^2$

New radius $= r' = 1.25r$

New surface area $= A' = 4\pi (r')^2$

$= 4\pi (1.25r)^2 = 4\pi r^2 (1.5625)$

increase % in surface area $= \frac{\text{New S.A} - \text{old S.A}}{\text{old S.A}} \times 100$

$= \frac{A' - A}{A} \times 100 = \frac{1.5625A - A}{A} \times 100 = \frac{0.5625A}{A} \times 100$

Ans = 56.25%

(22) Co-efficient of variation $C.V = \frac{\sigma}{\bar{x}} \times 100$ (4)

$\sigma = 6.5$, $\bar{x} = 12.5$

$C.V = \frac{6.5}{12.5} \times 100$

$\boxed{C.V = 52\%}$

(23) If $f(x) = 3 + x$, $g(x) = x - 4$

check $fog = gof$.

$fog(x) = f(g(x)) = f(x-4) = 3 + x - 4 = x - 1$ ... (1)

$gof(x) = g(f(x)) = g(3+x) = 3 + x - 4 = x - 1$ ... (2)

From (1) and (2)

$\boxed{fog = gof}$

(24) 1, 3, 9 ... t_{25}

$a = 3$, $r = \frac{t_2}{t_1} = \frac{3}{1} = 3$

$t_n = ar^{n-1}$

$t_{25} = 1 \times (3)^{25-1}$

$t_{25} = 3^{24}$

(25) Find the 19th term of an AP

$-11, -15, -19 \ldots$

$a = -11$ $d = t_2 - t_1 = -15 - (-11) = -15 + 11 = -4$

$\boxed{d = -4}$ $n = 19$

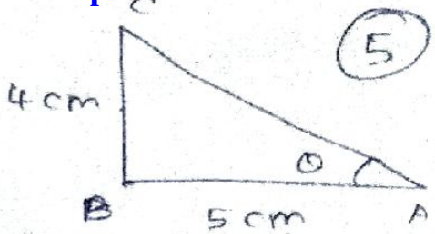
$t_n = a + (n-1)d$

$= -11 + (19-1)(-4)$

$= -11 + 18(-4) = -11 - 72$

$\boxed{t_{19} = -83}$

In the right angle ABC.



(5)

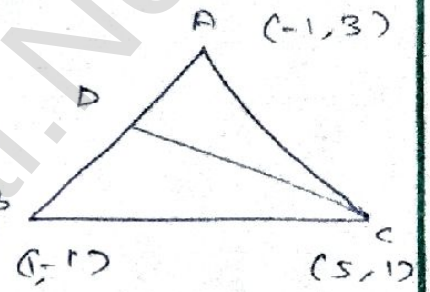
$\tan\theta = \frac{BC}{AB} = \frac{4}{5}$

$\theta = \tan^{-1}\left(\frac{4}{5}\right)$

$\theta = \tan^{-1}(0.8)$

$\boxed{\theta = 38.7^\circ}$

(27) The vertices (முனைகள்) A(-1, 3) B(1, -1) C(5, 1)



Median is DC.

Midpoint of AB is $D = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$= \left(\frac{1-1}{2}, \frac{-1+3}{2}\right) = \left(\frac{0}{2}, \frac{2}{2}\right)$

$\boxed{D = (0, 1)}$

Length of median CD C(5, -1) (0, 1)
$x_1\ y_1$ $x_2\ y_2$

$= \sqrt{(5-0)^2 + (-1-1)^2}$

$= \sqrt{5^2 + (-2)^2} = \sqrt{25+4} = \sqrt{29}$

5 marks

28. $f(x) = 3x + 2$

The function $f: N \to N$ defined by $f(x) = 3x + 2$

(i) If $x = 1$ $f(1) = 3(1) + 2 = 5$

$x = 2$ $f(2) = 3(2) + 2 = 8$

$x = 3$ $f(3) = 3(3) + 2 = 11$

(ii) If x is the pre image of 29 then $f(x) = 29$ $3x + 2 = 29$

$3x = 27 \Rightarrow \boxed{x = 9}$ x is the pre image of 53 $f(x) = 53$

$3x + 2 = 53$ $3x = 51$ $x = 17$

Thus the pre image of 29 and 53 are 9 and 17

(iii) one - one function.

(29) Let $f(x) = \frac{x}{2} - 1$ (6)

$A = \{2, 4, 6, 10, 12\}$ $B = \{0, 1, 2, 4, 5, 9\}$

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

$f(4) = \frac{4}{2} - 1 = 2 - 1 = 1$

$f(6) = \frac{6}{2} - 1 = 3 - 1 = 2$

$f(10) = \frac{10}{2} - 1 = 5 - 1 = 4$

$f(12) = \frac{12}{2} - 1 = 6 - 1 = 5$

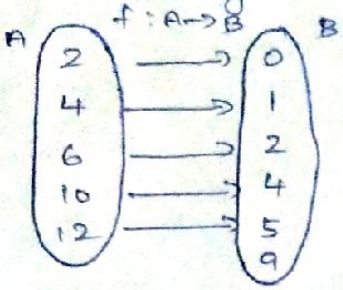
(i) Set of ordered pairs

(2,0) (4,1) (6,2) (10,4) (12,5)

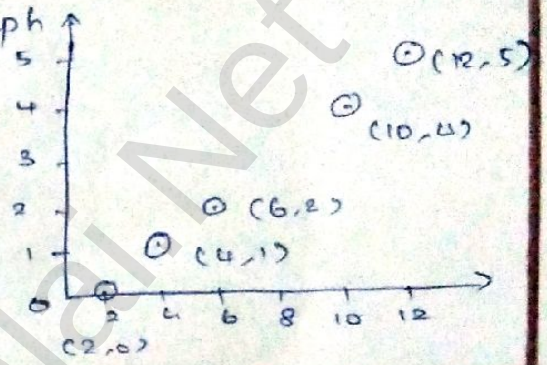
(ii) Table

x	2	4	6	10	12
f(x)	0	1	2	4	5

(iii) Arrow diagram



(iv) graph



(30) $\frac{t_6}{t_8} = \frac{7}{9}$

$\frac{a+5d}{a+7d} = \frac{7}{9}$

$9a + 45d = 7a + 49d$

$9a - 7a = 49d - 45d$

$2a = 4d$

$\boxed{a = 2d}$

substitute $a = 2d$ in

$\frac{t_9}{t_{13}} = \frac{a+8d}{a+12d}$

$= \frac{2d+8d}{2d+12d}$

$= \frac{10d}{14d} = \frac{5}{7}$

$\boxed{t_9 : t_{13} = 5 : 7}$

(31) prove that $S_3 = 3(S_2 - S_1)$

S_1, S_2 and S_3 are sum of first $n, 2n, 3n$ terms of an A.P

$S_1 = \frac{n}{2}[2a + (n-1)d]$, $S_2 = \frac{2n}{2}[2a + (2n-1)d]$ $S_3 = \frac{3n}{2}[2a + (3n-1)d]$

$S_2 - S_1 = \frac{2n}{2}[2a + (n-1)d] - \frac{n}{2}[2a + (n-1)d]$

$= \frac{n}{2}[4a + 2(2n-1)d] - [2a + (n-1)d]$

$S_2 - S_1 = \frac{n}{2} \times [2a + (3n-1)d]$

$3(S_2 - S_1) = \frac{3n}{2}[2a + (3n-1)d]$

$\boxed{3(S_2 - S_1) = S_3}$

(32) Find the values of m and n

(7)

$\frac{1}{x^2} - \frac{3}{x} + 2$ | $\frac{1}{x^4} - \frac{6}{x^3} + \frac{13}{x^2} + \frac{m}{x} + n$

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

$\frac{2}{x^2} - \frac{3}{x}$ | $-\frac{6}{x^3} + \frac{13}{x^2}$

$-\frac{6}{x^3} + \frac{9}{x^2}$

$\frac{2}{x^2} - \frac{6}{x} + 2$ | $\frac{4}{x^2} + \frac{m}{x} + n$

$\frac{4}{x^2} - \frac{12}{x} + 4$

$m = -12 \quad n = 4$

(33) Given equation $2x^2 - x - 1 = 0$

$a = 2,\ b = -1,\ c = -1$

$\alpha + \beta = -\frac{b}{a} = -\left(\frac{-1}{2}\right) = \frac{1}{2}$

$\alpha\beta = \frac{c}{a} = -\frac{1}{2}$

The roots are $\alpha^2\beta,\ \beta^2\alpha$

Sum of roots $= \alpha^2\beta + \beta^2\alpha$

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

$= \left(-\frac{1}{2}\right)\left(\frac{1}{2}\right) = -\frac{1}{4}$

Product of roots $= (\alpha^2\beta)(\beta^2\alpha)$

$= \alpha^3\beta^3$

$= (\alpha\beta)^3$

$= \left(-\frac{1}{2}\right)^3$

$= -\frac{1}{8}$

The Required equation

$x^2 - (\text{sum of roots})x + \text{product of roots} = 0$

$x^2 - \left(-\frac{1}{4}\right)x + \left(-\frac{1}{8}\right) = 0 \qquad \times 8$

$8x^2 + 2x - 1 = 0$

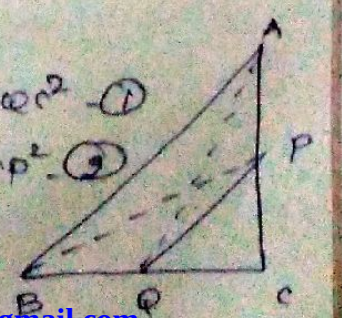
(34) To prove $4(AQ)^2 + BP^2) = 5AB^2$

$\triangle AQC$ is a right triangle at C $AQ^2 = AC^2 + QC^2$ — (1)

$\triangle BPC$ is a right triangle at C $BP^2 = BC^2 + CP^2$ — (2)

From (1) and (2)

$AQ^2 + BP^2 = AC^2 + QC^2 + BC^2 + CP^2$



(8)

$4(AQ^2 + BP^2) = 4AC^2 + 4QC^2 + 4BC^2 + 4CP^2$

$= 4AC^2 + (2QC)^2 + 4BC^2 + (2CP)^2$

$= 4AC^2 + BC^2 + 4BC^2 + AC^2$ (P, Q midpoints)

$= 5(AC^2 + BC^2)$

$\boxed{4(AQ^2 + BP^2) = 5AB^2}$ proved.

(35) Point $(1, -4)$ ratio of intercept $= 2:5$

slope of line $= -\frac{5}{2} \Rightarrow m = -\frac{5}{2}$

Eqn of straight line $y - y_1 = m(x - x_1)$

$y + 4 = -\frac{5}{2}(x - 1)$

$2y + 8 = -5x + 5$

$5x + 2y + 8 - 5 = 0$

$\boxed{5x + 2y + 3 = 0}$

(36) From the figure

$\tan LE = \tan 60°$

$\sqrt{3} = \frac{60}{y}$

$\sqrt{3}y = 60$

$y = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$y = \frac{60\sqrt{3}}{3} = 20\sqrt{3}$

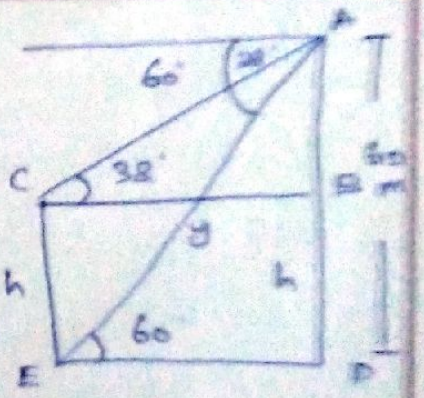
$\tan L = \frac{x}{y}$

$0.7813 = \frac{x}{20\sqrt{3}}$

$x = 20\sqrt{3} \times 0.7813$

$= 20 \times 1.732 \times 0.7813$

$= 27.064$



The height of the lamp post $= CE$

$CE = BD = 60 - 27.064 = 32.93$ m

(37) inner radii $= r$

outer radii $= R$

$d = 14$ cm $\quad r = 7$ cm

thickness $= 1$ mm

outer radius $R = 7 + \frac{1}{10}$

$= \frac{71}{10} = 7.1$ cm

Volume of sphere $= \frac{4}{3}\pi(R^3 - r^3)$

$= \frac{4}{3} \times \frac{22}{7}(7.1^3 - 7^3)$

$= 62.48$ cm^3

weight of brass in 1 cm^3 $= 17.8$ g

Total weight $= 17.8 \times 62.48$

$\boxed{\text{T. W} = 1080.944 \text{ g} = 1 \text{ kg}}$

(38) Find the co-efficient of variation

24, 26, 33, 37, 29, 31 (9)

x	$d = x - \bar{x}$	d^2
24	-6	36
26	-4	16
33	3	9
37	7	49
29	-1	1
31	+1	1
180	$\Sigma d = 0$	112

$\bar{x} = \frac{\Sigma x}{n} = \frac{180}{6}$

$\boxed{\bar{x} = 30}$

$\sigma = \sqrt{\frac{\Sigma d^2}{6}} = \sqrt{\frac{112}{6}}$

$\sigma = \sqrt{18.66}$

$\boxed{\sigma = 4.32}$

co-efficient of variation $C.V = \frac{\sigma}{\bar{x}} \times 100\%$

$C.V = \frac{4.32}{30} \times 100$

$\boxed{C.V = 14.4\%}$

(39) Two dice rolled in same time

$n(S) = \{ (1,1)(1,2)(1,3)(1,4)(1,5)(1,6)$
$(2,1)(2,2)(2,3)(2,4)(2,5)(2,6)$
$(3,1)(3,2)(3,3)(3,4)(3,5)(3,6)$
$(4,1)(4,2)(4,3)(4,4)(4,5)(4,6)$
$(5,1)(5,2)(5,3)(5,4)(5,5)(5,6)$
$(6,1)(6,2)(6,3)(6,4)(6,5)(6,6) \}$

(i) 8

$A = \{ (2,6)(3,5)(4,4)(5,3)(6,2) \}$

$n(A) = 5$ $P(A) = 5/36$

(ii) 13

$B = \{ \}$

$n(B) = 0$ $P(B) = 0$

(iii) less than or equal to 12.

$n(C) = 36$ $P(C) = \frac{36}{36} = 1$

(40) Let first integer = x

Second integer = $x+1$

Sum of Squares = 365.

$x^2 + (x+1)^2 = 365$

$x^2 + x^2 + 2x + 1 = 365$

$2x^2 + 2x - 364 = 0 \quad \div 2$

$x^2 + x - 182 = 0$

$(x+14)(x-13) = 0$

-182

$14 \quad -13$

$x + 14 = 0$

$\boxed{x = -14}$

$x - 13 = 0$

$\boxed{x = 13}$

The numbers are 13, 14

(10)

(41) cylinder

$r = 12$ cm $h = 18$ cm

cone

$h = 24$ cm $r = ?$

$l = ?$

Volume of cone = volume of cylinder

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

$\frac{1}{3} \times r^2 \times 24 = 12 \times 12 \times 18$

$r^2 = \frac{12 \times \overset{3}{\cancel{12}} \times \cancel{18} \times \overset{9}{\cancel{3}}}{\cancel{24}\ \cancel{8}\ \cancel{1}}$

$r^2 = 4 \times 3 \times 3 \times 9$

$r^2 = 36 \times 9$

$r = 6 \times 3$

$\boxed{r = 18 \text{ cm}}$

$l^2 = r^2 + h^2$

$= 18^2 + 24^2$

$= 324 + 576$

$l^2 = 900$

$\boxed{l = 30 \text{ cm}}$