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10th Std Maths

1. Points to be familiarized by the10th Students

2. All Unit Exercise Solutions

According to my view, the order and it's weightage of any problem is

1. Understanding the question - 24 %
2. To know the way to solve it - 24 %
3. To know the formulae related to it - 24 %
4. Quick and shortcut method of calculation - 24 %
5. Neatness - 4 %

Total - 100 %

வைத்ததொரு கல்வி மனப்பழக்கம். – ஔவையார்.

Wish you all the Best!

Each and Every 10th Student Must familiar with the following Basic and Essential Concepts which have been already studied in the previous classes.

1. Clear understanding of the various numbers such as Natural ($\mathbb{N}$), Whole ($\mathbb{W}$), Integer ($\mathbb{Z}$), Rational ($\mathbb{Q}$), Irrational ($\mathbb{Q}'$), Real numbers($\mathbb{R}$) and the differences between them.

2. Also Odd number, Even number, Prime numbers and Composite numbers upto 100, Prime factors, Perfect square numbers (1,4,9,16,25, .. etc), Perfect cube numbers. (1, 8,27,64,125,..etc)

3. Shortcuts and BODMAS in $+, -, \times, \div$ for Quickness. i.e. 190 x 30 = 5700 etc

4. Knowing all the fractions (Proper, Improper, Mixed, Like, Unlike), shortcut to find LCM for it's operations. (For example LCM of 5 and 25 is 25 because 25 is divisible by 5. LCM of 11 and 12 is (11x12) = 132 because of consecutive numbers & also for consecutive odd numbers but this not applicable consecutive odd numbers and etc like this.)

5. Proportions, Ratios and Conversion of Ratios → Fraction → Percentage → Decimal etc.

6. Decimal numbers calculations and placing correct decimal point during multiplication.

7. Sharpness of placing (+, –) signs during fundamental operations. i.e. $(-2)^2 = 4$; $(-2)^3 = -8$ etc.

8. Divisibility checks for easy cut shorting the fractions. (For 2, 3, 4, 5, 6, 8, 9, 10, 11, etc)

9. Squares of numbers up to 20. Shortcut methods to find the squaring.

1^2	2^2	3^2	4^2	5^2	6^2	7^2	8^2	9^2	10^2	11^2	12^2	13^2	14^2	15^2	16^2	17^2	18^2	19^2	20^2
1	4	9	16	25	36	49	64	81	100	121	144	169	196	225	256	289	324	361	400

35 x 35 =(3x4)(5x5) = 1225; 65 x 65 =(6x7)(5x5) = 4225; 105 x 105 =(10x11)(5x5) = 11025
$13^2 = 169$; $\therefore 130^2 = 16900$; $1300^2 = 1690000$; $600^2 = 360000$; $2500^2 = 6250000$
$20^2 = 400$; $\therefore 21^2 = 400 + (20+21) = 441$; $19^2 = 400 - (20+19) = 361$; $29^2 = 900 - (30+29) = 841$
$99^2 = 10000 - (100+99) = 9801$; $201^2 = 40000 + (200+201) = 40401$; Practice likewise.

10. Actual method of Square rooting the numbers of perfect squares and other numbers and decimals. As per (8) we can easily find out certain square roots. If the unit places are 1, 4, 5, 6, 9 and with ending 00, 0000 etc then it may be a perfect square (not sure). But If the unit places are 2, 3, 7, 8 and ending with 0, 000, 00000, then it will never be a perfect square. (Note : A shortcut to find out square root is attached. It is much useful for the 8th chapter.)

11. Knowing of $\sqrt{2} = 1.414$; $\sqrt{3} = 1.732$; $\sqrt{5} = 2.236$; $\sqrt{6} = 2.45$; $\sqrt{10} = 3.16$ etc will be better.

12. Similarly remember the cubes of numbers up to 10 and cube roots of it.

13. Surds rules like $\sqrt{6} = \sqrt{3 \times 2} = \sqrt{3} \times \sqrt{2}$; $8\sqrt{5} + 3\sqrt{5} = 11\sqrt{5}$; $5\sqrt{7} - 4\sqrt{7} = \sqrt{7}$ etc

14. Exponents rules such as : $a^m \, x \, a^n = a^{m+n}$; $\frac{a^m}{a^n} = a^{m-n}$; $(ab)^m = a^m \times b^m$; $a^0 = 1$
$a^m = \frac{1}{a^{-m}}$; $a^{-m} = \frac{1}{a^m}$; $a^{m^n} = a^{mn}$; $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ etc

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15. The Algebraic Identities (1). $(x+y)^2 = x^2 + 2xy + y^2$; (2). $(x-y)^2 = x^2 - 2xy + y^2$
(3). $x^2 - y^2 = (x+y)(x-y)$; (4). $(x+y)^3 = x^3 + 3xy(x+y) + y^3$ $(or) = x^3 + 3x^2y + 3xy^2 + y^3$
(5). $(x+y)^3 = x^3 - 3xy(x-y) + y^3$ $(or) = x^3 - 3x^2y + 3xy^2 - y^3$
(6). $x^3 + y^3 = (x+y)(x^2 - xy + y^2)$; (7). $x^3 - y^3 = (x-y)(x^2 + xy + y^2)$ are very important and practice it with left to right and right to left since both will be involved in the sums.

16. Well practice in the Factorisation of quadratic equations is also very important because it is invariably used almost in all the chapters.

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17. Daily before going to sleep, remember all the formulae involved in all the chapters for 10 mts.

18. For best result obey the 1st Teachers & 2nd Parents, because they will bless in mind and not by word. If anything left here and anything you forget in the above, clear it with the near & dear.

10th Maths Unit Exercise Chapter – 1

1. Given : $(x^2 - 3x, y^2 + 4y)$ and $(-2, 5)$ are equal

$(x^2 - 3x, y^2 + 4y) = (-2, 5)$

i.e. $x^2 - 3x = -2$	$y^2 + 4y = 5$
$x^2 - 3x + 2 = 0$	$y^2 + 4y - 5 = 0$
$(x - 2)(x - 1) = 0$	$(y + 5)(x - 1) = 0$
$x = 1, 2$	$y = -5, 1$

2 . Given : $n(A \times A) = 9$ Also two ordered pairs = (–1, 0) and (0,1)

$n(A) \times n(A) = 9$ $\therefore n(A) = 3$

From the given two ordered pairs = (–1, 0) and (0,1)

A = {–1, 0, 1} ; ∴ A x A = {–1, 0, 1} x {–1, 0, 1}

= {(–1, –1), (–1, 0), (–1, 1), (0, –1), (0, 0), (0, 1), (1, –1), (1, 0), (1, 1)}

3. Given : $f(x) = \begin{cases} \sqrt{x-1}, & x \geq 1 \\ 4, & x < 1 \end{cases}$

(i) f (0) = 4 [$\because 0 < 1$, It is satisfy 2nd condition]

(ii) f (3) = $\sqrt{3-1} = \sqrt{2}$ [$\because 3 \geq 1$ It is satisfy 1st condition]

(iii) f (a +1) = $\sqrt{(a+1)-1} = \sqrt{a}$ [$\because 0 + 1 \geq 1$ It is satisfy 1st condition]

4. Given : A = {9, 10, 11, 12, 13, 14, 15, 16, 17}

f (n) = the highest prime factor (Note : 1 is neither a prime nor a composite)

f (9) = (9 = 3 x 3), ∴the highest prime = 3

f (10) = (10 = 2 x 5), ∴the highest prime = 5

f (11) = It's prime number, (11 = 1x11) ∴the highest prime = 11

f (12) = (12 = 2 x 2 x 3), ∴the highest prime = 3

f (13) = It's prime number,(13 = 1x13) ∴the highest prime = 13

f (14) = (14 = 2 x 7), ∴the highest prime = 7

f (15) = (15 = 3 x 5), ∴the highest prime = 5

f (16) = (16 = 2 x 2 x 2 x 2), ∴the highest prime = 2

f (17) = It's prime number, (17 = 1x17) ∴the highest prime = 17

f = {(9, 3), (10, 5), (11, 11), (12, 3), (13, 13), (14, 7), (15, 5), (16, 2), (17, 17)}

Range f = {2, 3, 5, 7, 11, 13, 17}

5. Given : $f(x) = \sqrt{1 + \sqrt{1 - \sqrt{1 - x^2}}}$

When x = 0 ; $f(0) = \sqrt{1 + \sqrt{1 - \sqrt{1 - 0}}} = 1$

When x = 1 ; $f(1) = \sqrt{1 + \sqrt{1 - \sqrt{1 - 1}}} = \sqrt{2}$

When x = –1 ; $f(-1) = \sqrt{1 + \sqrt{1 - \sqrt{1 - 1}}} = 1$

When x = 2 ; $f(2) = \sqrt{1 + \sqrt{1 - \sqrt{1 - 4}}} = \sqrt{1 + \sqrt{1 - \sqrt{-3}}}$ is an imaginary

When x = –2 ; $f(-2) = \sqrt{1 + \sqrt{1 - \sqrt{1 - 4}}} = \sqrt{1 + \sqrt{1 - \sqrt{-3}}}$ is an imaginary

From the above, except (–1, 0, 1) the result for the other value of x become an imaginary one.

∴ The domain = {–1, 0, 1}

6. Given : f (x) = x^2 , g(x) = 3x and h(x) = x −2 ; To prove : $(f\ o\ g)\ o\ h\ =\ f\ o\ (g\ o\ h)$

$$(f\ o\ g)\ =\ f\left(g\ (x)\right)$$
$$=\ f\ (3x)$$
$$=\ (3x)^2\ =\ 9x^2$$
$$(f\ o\ g) o\ h\ =\ f\ o\ g\ (h(x))$$
$$=\ f\ o\ g\ (x-2)$$
$$=\ 9(x-2)^2 \text{ -------- } ①$$

$$(g\ o\ h)\ =\ g\left(h\ (x)\right)$$
$$=\ g\ (x-2)$$
$$=\ 3(x-2)$$
$$f\ o\ (g\ o\ h) = f(goh)$$
$$=(3(x-2))^2$$
$$=9(x-2)^2 \text{ ------- } ②$$

since ① = ② , $(f\ o\ g)\ o\ h\ =\ f\ o\ (g\ o\ h)$ (Proved)

7. This question is also given as multiple choice no. ③

Given : A = {1,2} ; B = {1,2, 3, 4} ; C = {5,6} ; D = {5, 6, 7, 8}; To show : $A \times C\ \subset\ B \times D$

A x C = {1, 2} x {5, 6} = {(1, 5), (1, 6), (2, 5), (2, 6)} ------- ①

B x D = {1,2, 3, 4} x {5, 6, 7, 8} = {(1, 5), (1, 6), (2, 5), (2, 6)}

= {(1, 5), 1, 6), (1, 7), (1, 8), (2, 5), (2, 6), (2, 7), (2, 8), (3, 5), (3, 6), (3, 7), (3, 8),

(4, 5), (4, 6), (4, 7), (4, 8)} ------- ②

Comparing ① & ② : $A \times C\ \subset\ B \times D$ (Proved)

8. Given : If $f(x) = \frac{x-1}{x+1}$ show that $f\left(f(x)\right) = -\frac{1}{x}$

$$f(x) = \frac{x-1}{x+1}$$

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

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

$$= \frac{-2}{2x} = -\frac{1}{x} \quad \text{(Proved)}$$

9. Given : $f(x) = 6x+8$; $g(x) = \frac{x-2}{3}$

(i) $gg(x) = g\left(g(x)\right) = \frac{\frac{x-2}{3}-2}{3}$

$$= \frac{x-2-6}{3\times 3} = \frac{x-8}{9}$$

$$gg(x) = \frac{x-8}{9}$$

$$gg\left(\frac{1}{2}\right) = \frac{\frac{1}{2}-8}{9}$$

$$= \frac{1-16}{2\times 9}$$

$$= -\frac{15}{2\times 9} = -\frac{5}{6}$$

(ii) $gf(x) = g(f(x))$

$$= g(6x+8)$$

$$= \frac{6x+8-2}{3}$$

$$= \frac{6x+6}{3}$$

$$= \frac{6(x+1)}{3}$$

$$= 2(x+1)$$

10. (i). $f(x) = \frac{2x+1}{x-9}$ By seeing the denominator except x = 9 , the other values x are defined

∴ Domain of f = ℝ – { 9 } (Note : ℝ means Real number)

(ii). $p(x) = \frac{-5}{4x^2+1}$ **By seeing the denominator, all values x is defined**

∴ **Domain of p = $\mathbb{R}$**

(iii). $g(x) = \sqrt{x-2}$ **By seeing the Square root , when x < 2, it will become an imaginary.**

∴ **Domain of g = $[2, \infty)$**

(ii). $h(x) = x + 6$ $h(x)$ **is defined all values x**

∴ **Domain of h = $\mathbb{R}$**

Unit Exercise Chapter – 2

1. To Prove : n^2 – n divisible by 2 for every positive integer n.

$$n^2 - n = n(n-1)$$

Here, when n = Odd, n – 1 becomes even

when n = Even, n – 1 becomes odd

The product of one odd and one even is always an even number which is divisible by 2

∴ **n^2 – n divisible by 2 for every positive integer n.**

2. Cow's milk = 175 litres ; Buffalow's milk = 105 litres

The milkman wants to them separately with equal sizes of can

∴ **The size can is the HCF 175, 105**

175 = 5 x 5 x 7 ; 105 = 3 x 5 x 7 ∴ The HCF = 5 x 7 = 35

(i) Capacity of a can = 35 litre

(ii) Number of cans of cow's milk : $\frac{175}{35} = 5$

(iii) Number of cans of buffalow's milk : $\frac{105}{35} = 3$

3. As per given codition,

When a is divisible by 13, the remainder is 9

∴ **a ≡ 9 (mod 13) ------ ①**

Similarly b ≡ 7 (mod 13) ------ ②

Similarly c ≡ 10 (mod 13) ------ ③

② x 2 → 2b ≡ 14 (mod 13) (Multiplication of Modulo arithmetic)

2b ≡ 1 (mod 13)

③ x 3 → 3c ≡ 30 (mod 13)

3c ≡ 4 (mod 13)

a + 2b + 3c ≡ (9 +1+4) (mod 13) (Addition of Modulo arithmetic)

a + 2b + 3c ≡ 14 (mod 13)

a + 2b + 3c ≡ 1 (mod 13)

∴ **When (a + b + c) is divisible by 13 , the remainder is 1.**

4. Let 107 = 4q + 3

107 – 3 = 4q

104 = 4q

∵ **104 is divisible by 4 for any integer q, 107 is of the form 4q + 3.**

5. Let a and d be the 1st term and common difference of an AP

It's n th term $t_n = a + (n-1)d$

(m+1) th term $t_{m+1} = a + (m+1-1)d$

$= a + md$ ------ ①

(n+1) th term $t_{n+1} = a + (n+1-1)d$

$= a + nd$ ------ ②

② x 2 → $2(t_{n+1}) = 2[a + nd]$ ------ ③

From the condition ① = ③

$a + md = 2[a + nd]$ ------ ④

$t_{3m+1} = a + (3m+1-1)d$

$= a + 3md$

$= a + md + 2md$

$= 2(a + nd) + 2md$ 〔As per ④〕

$= 2(a + md + nd)$

$= 2[a + (m+n)d]$

$= 2[a + (m+n+1-1)d]$

$= 2t_{m+n+1}$

∴ (3m+1) th term = 2 x (m+n+1) th term

6. Given A. P = –2, –4, –6,... –100 ; It's 1st term a = – 2 ; d = – 2

By reversing the A.P = –100, –98, –96, …, –2 ; Now a = –100, d = 2

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

12th term t_{12} = –100 + (12 – 1)2

t_{12} = –100 + 22 = –78

7. Given :

	AP_1	AP_2
1st term	2	7

Common difference is same for both AP's

Difference of 1st terms of two AP's = 2 – 7 = – 5

Since the common difference is same for both, then

The Difference of any corresponding terms two AP's = – 5

∴ t_{10} of AP_1 – t_{10} of AP_2 = – 5

t_{21} of AP_1 – t_{21} of AP_2 = – 5

∴ t_n of AP_1 – t_n of AP_2 = – 5

8. Given : S_{10} = 16500,

Let the 1st year savings = a

The 2nd year savings = a + 100

The 3rd year savings = a + 100 + 100 = a + 200

It forms an AP with a common difference d = 100

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

$$S_{10} = \frac{10}{2}[2a + (10-1)100] = 16500$$

$$5[2a + 900] = 16500$$

$$2a + 900 = \frac{16500}{5} = 3300$$

$$2a = 3300 - 900 = 2400$$

$$\therefore a = \frac{2400}{2} = 1200$$

1st year he saved Rs 1200

9. Given : 2nd term of a GP i.e. $ar = \sqrt{6}$

6th term of a GP i.e. $ar^5 = 9\sqrt{6}$

$$\frac{ar^5}{ar} = \frac{9\sqrt{6}}{\sqrt{6}}$$

$$r^4 = 9$$

$$r^2 = 3$$

$$r = \sqrt{3},\ -\sqrt{3}$$

① **When** $r = \sqrt{3}$, $ar = \sqrt{6}$; $a = \frac{\sqrt{6}}{r} = \frac{\sqrt{3}\times\sqrt{2}}{\sqrt{3}} = \sqrt{2}$

② **When** $r = -\sqrt{3}$, $ar = \sqrt{6}$; $a = \frac{\sqrt{6}}{r} = \frac{\sqrt{3}\times\sqrt{2}}{-\sqrt{3}} = -\sqrt{2}$

GP : $a,\ ar,\ ar^2, \ldots$

GP as per ① : $\sqrt{2},\ \sqrt{2}\times\sqrt{3},\ \sqrt{2}\times\sqrt{3}^2, \ldots$

$\sqrt{2},\ \sqrt{6},\ 3\sqrt{2}, \ldots$

GP as per ② : $-\sqrt{2},\ (-\sqrt{2})\times(-\sqrt{3}),\ (-\sqrt{2})\times(-\sqrt{3})^2, \ldots$

$-\sqrt{2},\ \sqrt{6},\ -3\sqrt{2}, \ldots$

10. Given : Value motor cycle (a) = ₹ 45000

Depriciation = 15%

To find : Value of the motor cycle after 3 years : n = 3

Depriciated value after 1 year = 45000 x (100 -15)% = 45000 x 85%

After 1 year $= 45000 \times \frac{85}{100}$

After 2 year $= 45000 \times \frac{85}{100} \times \frac{85}{100}$

After 3 year $= 45000 \times \frac{85}{100} \times \frac{85}{100} \times \frac{85}{100}$

= 27635.625

Value of the motor cycle after 3 years = ₹ 27635

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Unit Exercise Chapter – 3

(1) Taking First two

$$\frac{1}{3}(x+y-5) = y-z$$

$$x+y-5 = 3y-3z$$

$$x+y-3y+3z = 5$$

$$x-2y+3z = 5 \quad \text{——— (1)}$$

Taking middle two

$$y-z = 2x-11$$

$$y = 2x+z-11 \quad \text{——— (2)}$$

Put (2) in (1)

$$x-2(2x+z-11)-3z = 5$$

$$x-4x-2z+22-3z = 5$$

$$-3x+z = -17 \quad \text{——— (3)}$$

Taking Last two

$$2x-11 = 9-(x+2z)$$

$$2x+x+2z = 9+11$$

$$3x+2z = 20 \quad \text{——— (4)}$$

$$-3x+z = -17 \quad \text{——— (3)}$$

$$3x+2z = 20 \quad \text{——— (4)}$$

Adding

$$0+3z = 3$$

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

From (4) $3x+2\times1 = 20$

$$3x = 18$$

$$x = \frac{18}{3} = 6$$

Put $x=6$, $z=1$ in (2)

$$y = 2\times6+1-11$$

$$= 13-11 = 2$$

$$x=6,\ y=6,\ z=1$$

(2) Let x, y, z be the Students in A, B, C.

As per conditions.

$$x+y+z = 150 \quad \text{——— (1)}$$

$$x-6 = z+6$$

$$x = z+12 \quad \text{——— (2)}$$

$$4z-x = y$$

$$-x-y+4z = 0 \quad \text{——— (3)}$$

Putting (2) in (1)

$$z+12+y+z = 150$$

$$y+2z = 138 \quad \text{——— (4)}$$

Putting (2) in (3)

$$-(z+12)-y+4z = 0$$

$$-z-12-y+4z = 0$$

$$-y+3z = 12 \quad \text{——— (5)}$$

Adding (4) & (5) $5z = 150,\ \therefore z = 30$

$$x = z+12 = 30+12 = 42$$

$$y = 150-(30+42) = 78$$

Students in A = 42, B = 78, C = 30

(4) $xy(k^2+1)+k(x^2+y^2)$

$$= k^2xy+xy+kx^2+ky^2$$

$$= k^2xy+kx^2+ky^2+xy$$

$$= k^2xy+kx^2+ky^2+xy$$

$$= kx(ky+x)+y(ky+x)$$

$$= (kx+y)(ky+x)$$

$xy(k^2-1)+k(x^2-y^2)$

$$= k^2xy-xy+kx^2-ky^2$$

$$= k^2xy+kx^2-ky^2-xy$$

$$= kx(ky+x)-y(ky+x)$$

$$= (kx-y)(ky+x)$$

LCM of Both $= (ky+x)(kx+y)(kx-y)$

$$= (ky+x)(k^2x^2-y^2)$$

$$\text{LCM} = (ky+x)(k^2x^2-y^2)$$

(3) Let x, y, z be the 100^{th}, 10^{th} & unit place.

$\therefore$ The number $= 100x+10y+z$.

If 100^{th} & 10^{th} changed, then it is 54 more than thrice of original.

$$100y+10x+z = 3(100x+10y+z)+54$$

$$100y+10x+z-300x-30y-3z = 54.$$

$$-290x+70y-2z = 54$$

$\div$ by 2 $\rightarrow$ $-145x+35y-z = 27 \quad \text{——— (1)}$

If the digits are reversed then, it is 198 of the original.

$$100z+10y+x = 100x+10y+z+198$$

$$100z+10y+x-100x-10y-z = 198$$

$$-99x+99z = 198$$

$\div$ by 99 $\quad -x+z = 2$

$$z = x+2 \quad \text{——— (2)}$$

As per 3^{rd} condition.

$$y-x = 2(y-z)$$

$$y-x-2y+2z = 0$$

$$-x-y+2z = 0 \quad \text{——— (3)}$$

Putting (2) in (1)

$$-145x+35y-(x+2) = 27$$

$$-145x+35y-x-2 = 27$$

$$-146x+35y = 29 \quad \text{——— (4)}$$

Putting (2) in (3)

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

$$x-y = -4 \quad \text{——— (5)}$$

$$y = x+4$$

Putting (5) in (4)

$$-146x+35(x+4) = 29$$

$$-146x+35x+140$$

$$-111x = -111$$

$$x = 1.$$

From (2) $z = 1+2 = 3$

From (5) $y = 1+4 = 5.$

The Number $= 100\times1+10\times5+3 = 153.$

5) Let $f(x) = 2x^4+13x^3+27x^2+23x+7$

$g(x) = x^3+3x^2+3x+1$

$h(x) = x^2+2x+1.$

(i) $f(x) \div g(x)$

$$
\begin{array}{r|l}
 & 2x+7 \\
x^3+3x^2+3x+1 & 2x^4+13x^3+27x^2+23x+7 \\
 & 2x^4+6x^3+6x^2+2x \\
\hline
 & 7x^3+21x^2+21x+7 \\
 & 7x^3+21x^2+21x+7 \\
\hline
 & 0
\end{array}
$$

Since the remainder is zero, $g(x)$ is GCD of $f(x)$ and $g(x)$.

(ii) $g(x) \div h(x)$

$$
\begin{array}{r|l}
 & x+1 \\
x^2+2x+1 & x^3+3x^2+3x+1 \\
 & x^3+2x^2+x \\
\hline
 & x^2+2x+1 \\
 & x^2+2x+1 \\
\hline
 & 0
\end{array}
$$

Here also remainder $=0$

$\therefore$ The GCD $= x^2+2x+1$

6) (i) $\dfrac{x^{3a}+8}{x^{2a}+2x^a+4} = \dfrac{(x^a)^3+2^3}{(x^a)^2+2x^a+4}$

$= \dfrac{(x^a+2)\left[(x^a)^2+2x^a+2^2\right]}{\left[(x^a)^2+2x^a+4\right]}$

$= x^a+2$

(ii) $= \dfrac{10x^3-25x^2+4x-10}{-4-10x^2}$

$= \dfrac{5x^2(2x-5)+2(2x-5)}{-2(5x^2+2)}$

$= \dfrac{(5x^2+2)(2x-5)}{-2(5x^2+2)}$

$= \dfrac{2x-5}{-2} = -x+\dfrac{5}{2}$

8. Arul, Ravi, Ram together complete the work in 6 hr.

Their workmanship per hour $= \dfrac{1}{6}$

Let Arul complete it alone in x hr.

$\therefore$ Ravi " " " " $2x$ hr.

Ram " " " " $3x$ hr.

Their individual workmanship $= \dfrac{1}{x}, \dfrac{1}{2x}, \dfrac{1}{3x}$

$\therefore \dfrac{1}{x}+\dfrac{1}{2x}+\dfrac{1}{3x} = \dfrac{1}{6}$

$\dfrac{6+3+2}{6x} = \dfrac{1}{6}$

$\dfrac{11}{6x} = \dfrac{1}{6}$; $\therefore x = \dfrac{6\times 11}{6} = 11$ hrs.

$\therefore$ Arul complete it in 11 hrs

Ravi " " " 22 hrs

Ram " " " 33 hrs

9

$$
\begin{array}{r|l}
 & 17x^2-18x+19 \\
17x^2 & 289x^4-612x^3+970x^2+684x+361 \\
 & 289x^4 \\
\hline
34x^2-18x & -612x^3+970x^2 \\
 & -612x^3+324x^2 \\
\hline
34x^2-36x+19 & 646x^2+684x+361 \\
 & 646x^2+684x+361 \\
\hline
 & 0
\end{array}
$$

$\therefore$ The Square root: $17x^2-18x+19$

10) $\sqrt{y+1}+\sqrt{2y-5} = 3$

Squaring both sides,

$(\sqrt{y+1}+\sqrt{2y-5})^2 = 3^2$

$(\sqrt{y+1})^2+(\sqrt{2y-5})^2+2\sqrt{y+1}\times\sqrt{2y-5} = 9$

$y+1+2y-5+2\sqrt{(y+1)(2y-5)} = 9$

$3y-4+2\sqrt{2y^2-5y+2y-5} = 9$

$2\sqrt{2y^2-3y-5} = 13-3y$

Again squaring on both sides.

$(2\sqrt{2y^2-3y-5})^2 = (13-3y)^2$

$4(2y^2-3y-5) = 169+9y^2-78y$

$8y^2-12y-20 = 169+9y^2-78y$

$8y^2-12y-20-9y^2+78y-169 = 0$

$-y^2+66y-189 = 0$

$y^2-66y+189 = 0$

$(y-63)(y-3) = 0$

$y = 63, 3$

11) Speed $= \dfrac{\text{Dist}}{\text{Time}}$; Time $= \dfrac{\text{Dist}}{\text{Speed}}$.

Distance $= 36$ Km.

Speed of water current $= 4$ Km/hr

Let the speed of the boat $= x$ Km/hr

$\therefore$ Nett speed along the current $= x+4$

Net speed opposite to the current $= x-4$

Difference time $= 1.6$ hr $= \dfrac{16}{10} = \dfrac{8}{5}$

$t_2-t_1 = \dfrac{8}{5}$

$\dfrac{36}{x-4}-\dfrac{36}{x+4} = \dfrac{8}{5}$

$36\left[\dfrac{1}{x-4}-\dfrac{1}{x+4}\right] = \dfrac{8}{5}$

$36\left[\dfrac{x+4-x+4}{(x-4)(x+4)}\right] = \dfrac{8}{5}$

$\dfrac{36\times \cancel{8}}{x^2-16} = \dfrac{\cancel{8}^1}{5}$; $\therefore x^2-16 = 36\times 5$

$x^2 = 180+16 = 196$

$x = \pm 14$

Speed can not be negative.

$\therefore$ Speed of the boat $= 14$ Km/hr

(12) Rectangular Park

Perimeter = 320 m : Area = 4800 m^2

Let l, b be the length and breadth

$\therefore 2(l+b) = 320$

$l + b = 160$ —— (1)

$l \times b = 4800$; $l = \frac{4800}{b}$ —— (2)

Placing (2) in (1)

$\frac{4800}{b} + b = 160$

$\times$ by b, $4800 + b^2 = 160b$

$b^2 - 160b + 4800 = 0$

$(b-120)(b-40) = 0$

$b = 120$ or 40

4800 ; $-120 \mid -40$

$(-120)+(-40) = -160$

$(-120)\times(-40) = 4800$

$\therefore$ Taking Breadth = 40 m

Length = 120 m.

(13) The time past after 2 pm and the time need to 3 pm is

$t + \frac{t^2}{4} - 3 = 60$ mts.

$\times$ by 4 $\Rightarrow$ $4t + t^2 - 12 = 240$

$t^2 + 4t - 12 - 240 = 0$

$t^2 + 4t - 252 = 0$

$(t+18)(t-14) = 0$

-252 ; $+18 \mid -14$

$18 + (-14) = 4$

$18 \times (-14) = -252$

$t = -18$ or 14

$\because$ Time can not be negative,

$t = 14$ mts.

(14) Let the number of rows $= x$

As per condition, the number seats in a row also $= x$

$\therefore$ Total seats in the hall $= x \times x = x^2$

when row doubled $= 2x$

seat reduced to 5 $= x - 5$

As per the IInd condition,

$2x(x-5) = x^2 + 375$

$2x^2 - 10x = x^2 + 375$

$2x^2 - x^2 - 10x - 375 = 0$

$x^2 - 10x - 375 = 0$

$(x-25)(x+15) = 0$

-375 ; $-25 \mid +15$

$(-25)+15 = -10$

$(-25)\times 15 = -375$

$x = 25$ or -15

$\because x$ can not be a negative.

$\therefore$ The number of rows = 25

seats = 25

(16) Let $f(x) = x^2 + px - 4$

It has a root of (-4)

$f(-4) = (-4)^2 + p(-4) - 4 = 0$

$16 - 4p - 4 = 0$

$-4p = -12$

$p = \frac{-12}{-4} = -3.$

$g(x) = x^2 + px + q = 0$

It has equal roots.

For equal roots, $b^2 - 4ac = 0$

Here $a = 1$, $b = p$, $c = q$

$p^2 - 4 \times 1 \times q = 0$

$(-3)^2 - 4q = 0$

$9 - 4q = 0$

$4q = 9$

$q = \frac{9}{4}$

(15) $f(x) = x^2 - 2x + 3$

Here $a = 1$, $b = -2$, $c = 3$

Sum of roots $\alpha + \beta = \frac{-b}{a} = \frac{-(-2)}{1} = 2$

Product of the roots $\alpha\beta = \frac{c}{a} = \frac{3}{1} = 3.$

(i) $\alpha + 2$, $\beta + 2$

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

$= (\alpha + \beta) + 4$

$= 2 + 4 = 6$

Product of the roots $= (\alpha+2)(\beta+2)$

$= \alpha\beta + 2\alpha + 2\beta + 4$

$= \alpha\beta + 2(\alpha+\beta) + 4$

$= 3 + 2 \times 2 + 4 = 11$

The required equation,

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

$x^2 - 6x + 11 = 0.$

(ii) $\frac{\alpha-1}{\alpha+1}$, $\frac{\beta-1}{\beta+1}$.

Sum of roots $= \frac{\alpha-1}{\alpha+1} + \frac{\beta-1}{\beta+1}$

$= \frac{(\alpha-1)(\beta+1) + (\beta-1)(\alpha+1)}{(\alpha+1)(\beta+1)}$

$= \frac{\alpha\beta + \alpha - \beta - 1 + \alpha\beta + \beta - \alpha - 1}{\alpha\beta + \alpha + \beta + 1}$

$= \frac{2\alpha\beta - 2}{\alpha\beta + (\alpha+\beta) + 1} = \frac{2\times 3 - 2}{3 + 2 + 1} = \frac{4}{6} = \frac{2}{3}$

Product of roots $= \frac{(\alpha-1)}{(\alpha+1)} \times \frac{(\beta-1)}{(\beta+1)} = \frac{\alpha\beta - \alpha - \beta + 1}{\alpha\beta + \alpha + \beta + 1}$

$= \frac{\alpha\beta - (\alpha+\beta) + 1}{\alpha\beta + (\alpha+\beta) + 1} = \frac{3 - 2 + 1}{3 + 2 + 1} = \frac{2}{6} = \frac{1}{3}$

$\therefore$ The eqn. : $x^2 - \left(\frac{2}{3}\right)x + \frac{1}{3} = 0$

$\times$ by 3, $3x^2 - 2x + 1 = 0$

17. April Sales $A = \begin{bmatrix} 500 & 1000 & 1500 \\ 2500 & 1500 & 500 \end{bmatrix}$

It is doubled in May.

$\therefore$ May Sales : $2A = 2\begin{bmatrix} 500 & 1000 & 1500 \\ 2500 & 1500 & 500 \end{bmatrix}$

$\begin{bmatrix} 1000 & 2000 & 3000 \\ 5000 & 3000 & 500 \end{bmatrix}$

Average Sales $= \dfrac{A+2A}{2} = \dfrac{3}{2}\times A$

$= \dfrac{3}{2}\begin{bmatrix} 500 & 1000 & 1500 \\ 2500 & 1500 & 500 \end{bmatrix}$

$= \begin{bmatrix} 750 & 1500 & 2250 \\ 3750 & 2250 & 750 \end{bmatrix}$

April $= A$, May $= 2A$, June $= 4A$, July $= 8A$

$\therefore$ August $= 16A = 16\begin{bmatrix} 500 & 1000 & 1500 \\ 2500 & 1500 & 500 \end{bmatrix}$

$= \begin{bmatrix} 8000 & 16000 & 21000 \\ 40000 & 21000 & 8000 \end{bmatrix}$

18. $LHS = \cos\theta\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} + \sin\theta\begin{bmatrix} x & -\cos\theta \\ \cos\theta & x \end{bmatrix}$

$= \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ -\sin\theta\cos\theta & \cos^2\theta \end{bmatrix} + \begin{bmatrix} x\sin\theta & -\sin\theta\cos\theta \\ \sin\theta\cos\theta & x\sin\theta \end{bmatrix}$

$= \begin{bmatrix} \cos^2\theta + x\sin\theta & 0 \\ 0 & \cos^2\theta + x\sin\theta \end{bmatrix} = I_2$

$\therefore \begin{bmatrix} \cos^2\theta + x\sin\theta & 0 \\ 0 & \cos^2\theta + x\sin\theta \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$\cos^2\theta + x\sin\theta = 1$

$x\sin\theta = 1 - \cos^2\theta$

$x\sin\theta = \sin^2\theta$

$x = \dfrac{\sin^2\theta}{\sin\theta}$

$x = \sin\theta$

19. $A = \begin{bmatrix} p & 0 \\ 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -q \\ 1 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 2 & -2 \\ 2 & 2 \end{bmatrix}$

$BA = \begin{bmatrix} 0 & -q \\ 1 & 0 \end{bmatrix}\times\begin{bmatrix} p & 0 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 0 & -2q \\ p & 0 \end{bmatrix}$

$C^2 = C\times C = \begin{bmatrix} 2 & -2 \\ 2 & 2 \end{bmatrix}\times\begin{bmatrix} 2 & -2 \\ 2 & 2 \end{bmatrix}$

$= \begin{bmatrix} 2\times2+(-2)\times2 & 2\times(-2)+(-2)\times2 \\ 2\times2+2\times2 & 2\times(-2)+2\times2 \end{bmatrix}$

$= \begin{bmatrix} 0 & -8 \\ 8 & 0 \end{bmatrix}$

$BA = C^2$; $\begin{bmatrix} 0 & -2q \\ p & 0 \end{bmatrix} = \begin{bmatrix} 0 & -8 \\ 8 & 0 \end{bmatrix}$

$p = 8$, $-2q = -8$

$q = \dfrac{-8}{-2} = 4$

$p = 8$, $q = 4$

20. $A = \begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 6 & 3 \\ 8 & 5 \end{bmatrix}$, $C = \begin{bmatrix} 3 & 6 \\ 1 & 1 \end{bmatrix}$

$AB = \begin{bmatrix} 3\times6+0\times5 & 3\times3+0\times5 \\ 4\times6+5\times8 & 4\times3+5\times5 \end{bmatrix} = \begin{bmatrix} 18 & 9 \\ 64 & 37 \end{bmatrix}$

Let $D = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, $\therefore CD = \begin{bmatrix} 3 & 6 \\ 1 & 1 \end{bmatrix}\times\begin{bmatrix} a & b \\ c & d \end{bmatrix}$

$CD = \begin{bmatrix} 3a+6c & 3b+6d \\ a+c & b+d \end{bmatrix}$

$AB - CD = 0$, $\therefore CD = AB$

$\begin{bmatrix} 3a+6c & 3b+6d \\ a+c & b+d \end{bmatrix} = \begin{bmatrix} 18 & 9 \\ 64 & 37 \end{bmatrix}$

$\therefore 3a+6c = 18 \rightarrow a+2c = 6$ —— (1)

$3b+6d = 9 \rightarrow b+2d = 3$ —— (2)

$a+c = 64$ —— (3)

$b+d = 37$ —— (4)

cont....

20 Contd.

$a+2c = 6$ —— (1)

$a+c = 64$ —— (3)

(1) − (2) $\rightarrow$ $c = -58$

$\therefore a = 64 - c = 64 - (-58)$

$= 122$

$b+2d = 3$ —— (2)

$b+d = 37$ —— (4)

(2) − (4) $\rightarrow$ $d = -34$

$\therefore b = 37 - d = 37 - (-34)$

$= 71$

$D = \begin{bmatrix} 122 & 71 \\ -58 & -34 \end{bmatrix}$

—— x ——

7. $\dfrac{\frac{1}{p}+\frac{1}{q+r}}{\frac{1}{p}-\frac{1}{q+r}} = \dfrac{\frac{q+r+p}{p(q+r)}}{\frac{q+r-p}{p(q+r)}} = \dfrac{q+r+p}{q+r-p}$ —— (1)

$1+\dfrac{q^2+r^2-p^2}{2qr} = \dfrac{2qr+q^2+r^2-p^2}{2qr}$

$= \dfrac{(q+r)^2-p^2}{2qr}$

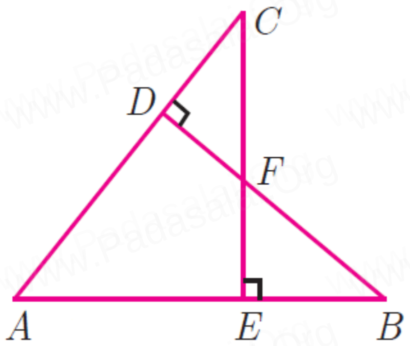
$= \dfrac{(q+r+p)(q+r-p)}{2qr}$ —— (2)

(1) × (2) $= \dfrac{(q+r+p)}{\cancel{(q+r-p)}}\times\dfrac{(q+r+p)\cancel{(q+r-p)}}{2qr}$

$= \dfrac{(p+q+r)^2}{2qr}$

—— x ——

10th Maths Unit Exercise Chapter – 4 Geometry



1. (i) Given : $BD \perp AC$, $CE \perp AB$

In $\triangle AEC$ and $\triangle ADB$,

$\angle AEC = \angle ADB = 90°$ (Given) ,

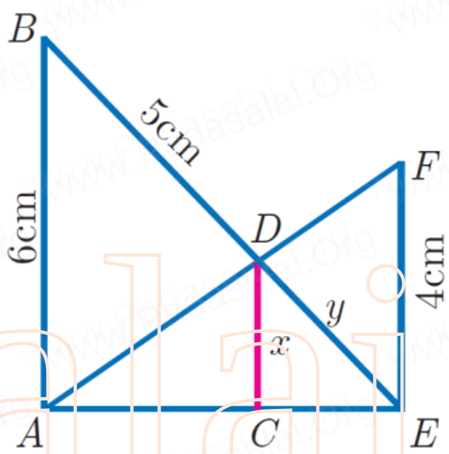
$\angle A$ is common for both the $\triangle AEC$ and $\triangle ADB$

When two angles are equal, the 3rd angles are also equal.

Due to AA symmetry, $\triangle AEC \sim \triangle ADB$ (Hence proved)

(ii) since $\triangle AEC \sim \triangle ADB$, $\frac{CA}{AB} = \frac{CE}{DB}$ (Hence proved)

2. Given : $AB \parallel CD \parallel EF$



In $\triangle DAB$ and $\triangle DFE$,

$\angle ADB = \angle FDE$ (∵Vertically opposite angle)

$\angle DAB = \angle DFE$ (Alternate angles are equal ∵ $AB \parallel EF$)

Due to AA symmetry, $\triangle ADB \sim \triangle FDE$

$\therefore \frac{DE}{DB} = \frac{FE}{AB} = \frac{DF}{DA}$;

$\frac{y}{5} = \frac{4}{6} = \frac{DF}{AD}$ ----------- ①

$y = \frac{4 \times 5}{6} = \frac{10}{3} = 3.33\ cm$

In $\triangle ADC$ and $\triangle AFE$, $CD \parallel EF$

By angular bisector theorem ,

$\frac{AD}{AF} = \frac{CD}{EF}$

$\frac{AD}{AF} = \frac{x}{4}$ ------------- ②

From ①, $\frac{DF}{AD} = \frac{4}{6} = \frac{2}{3}$

$\frac{DF}{AD} + 1 = \frac{2}{3} + 1$

$\frac{AD+DF}{AD} = \frac{2+3}{3}$

$\frac{AF}{AD} = \frac{5}{3}$ (or) $\frac{AD}{AF} = \frac{3}{5}$ ------------- ③

From ② and ③ $\frac{x}{4} = \frac{3}{5}$ or $x = \frac{4 \times 3}{5} = \frac{12}{5} = 2.4\ cm$

3. In the $\triangle ABC$, mark a point O inside to it at anywhere.

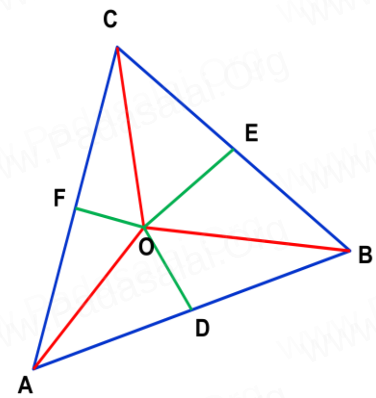
Joint OA, OB, OC.

Join OD as the angular bisector of $\angle AOB$ in $\triangle AOB$

Join OE as the angular bisector of $\angle BOC$ in $\triangle BOC$

Join OF as the angular bisector of $\angle COA$ in $\triangle COA$

As per Angular bisector theorem,



∵OD is the bisector of the $\angle AOB$ in the $\triangle AOB$, $\frac{AD}{DB} = \frac{AO}{BO}$ ------- ①

∵OE is the bisector of the $\angle AOB$ in the $\triangle BOC$, $\frac{BE}{EC} = \frac{BO}{CO}$ ------- ②

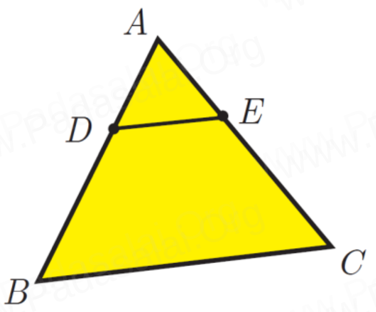
∵OD is the bisector to the $\angle AOB$ in the $\triangle COA$, $\frac{CF}{FA} = \frac{CO}{AO}$ ------- ③

① × ② × ③ → $\frac{AD}{DB} \times \frac{BE}{EC} \times \frac{CF}{FA} = \frac{AO}{BO} \times \frac{BO}{CO} \times \frac{CO}{AO}$

$\frac{AD}{DB} \times \frac{BE}{EC} \times \frac{CF}{FA} = 1$ $\therefore AD \times BE \times CF = DB \times EC \times FA$ (Proved)

4. In the given fig. $\because$ $AB = AC$, The $\triangle AOB$ is an equilateral $\triangle$

$\therefore \angle ABC \ or \ \angle DBC = \angle ACB \ or \angle ECB$ ------ 1



In the quadrilateral $BCED$, $DE \parallel BC$ $(\because AD = AE)$

$\because$ BD is transversal of BC and DE, $\angle EDB + \angle DBC = 180°$ ------ 2

$\because$ CE is transversal of BC and DE, $\angle DEC + \angle ECB = 180°$ ------ 3

From 1 and 2 $\angle EDB + \angle ECB = 180°$

From 1 and 3 $\angle DEC + \angle DBC = 180°$

From the above two ,

$\because$The sum of the opposite angles are $180°$, the quadrilateral **BCED lies on a same circle.**

i.e. **BCED is a cyclic quadrilateral.** (Proved)

5. Let O be Rly Station. From it,

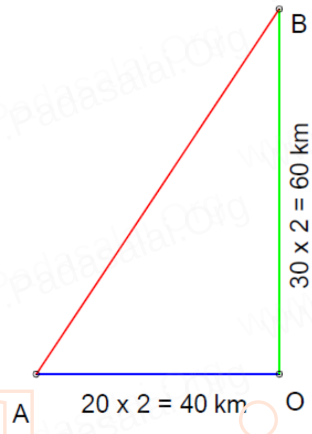
Train A departures towards (due) west at a speed of 20 km/hr

After 2 hour, Train A is at $20 \times 2 = 40\ km$ from O.

Train B departures towards (due) north at a speed of 30 km/hr

After 2 hour, Train B is at $30 \times 2 = 60\ km$ from O.

Now the points A, O, and B are form a Right Triangle.

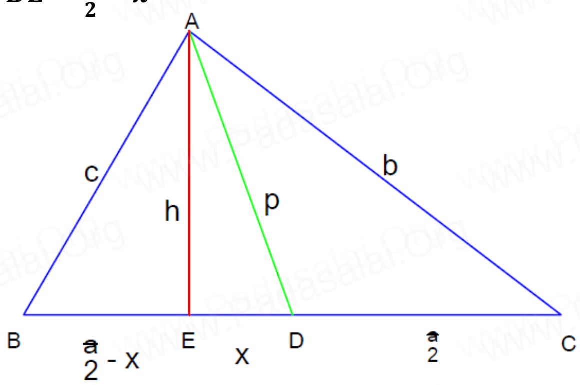


$$AB^2 = AO^2 + BO^2$$
$$AB = \sqrt{AO^2 + BO^2}$$
$$AB = \sqrt{40^2 + 60^2}$$
$$= \sqrt{1600 + 3600}$$
$$= \sqrt{5200} = \sqrt{400 \times 13} = 20\sqrt{13}\ km$$

6. (In the question the word "In a ΔABC" is missing. Anyhow)

In the fig. $AB = c$, $AC = b$, $BC = a$, $AD = p$, $AE = h$;

$\because$ D is the midpoint of BC, $BD = DC = \frac{a}{2}$, $ED = x$, $\therefore BE = \frac{a}{2} - x$



$\because$ $AE \perp BC$, the ΔAED is right triangle.

$$h^2 = p^2 - x^2 \text{ ------- } 1$$

(i) In right triangle ΔAEC,

$$AC^2 = AE^2 + EC^2$$
$$b^2 = h^2 + \left[x + \frac{a}{2}\right]^2$$

From 1 $\quad b^2 = p^2 - x^2 + x^2 + ax + \frac{a^2}{4}$

$b^2 = p^2 + ax + \frac{a^2}{4}$ (Proved) ----- 2

(ii) In right triangle ΔAEB,

$$AB^2 = AE^2 + EB^2$$
$$c^2 = h^2 + \left[x - \frac{a}{2}\right]^2$$

From 1 $\quad c^2 = p^2 - x^2 + x^2 - ax + \frac{a^2}{4}$

$c^2 = p^2 - ax + \frac{a^2}{4}$ (Proved) ------ 3

(iii) Adding 2 and 3 $\quad b^2 + c^2 = 2p^2 + \frac{a^2}{2}$ (Proved)

7. From the fig.

Man's eyelevel $CE = 2\ m$

Let Tree's height $AD = x\ m$

B is the mirror point

Now DB is incident ray, BE is reflected ray

Always *The angle of incident ray* $=$ *The angle of reflected ray*

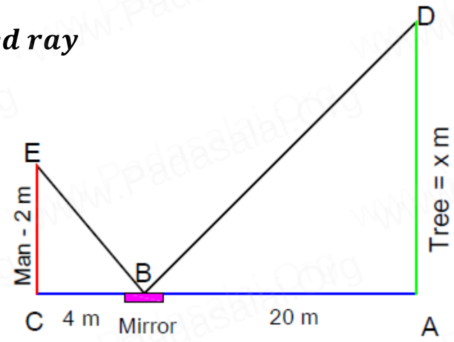
$\therefore\ \angle ABD = \angle CBE$

Also $\angle BAD = \angle BCE = 90^\circ$ ($\because \perp$ to the ground)

$\therefore$ Due to AA similarity, $\Delta BAD \sim \Delta BCE$,

$\frac{AD}{CE} = \frac{BA}{BC} \rightarrow \frac{x}{2} = \frac{20}{4}$

$x = \frac{20\times 2}{4} = 10\ m$



8. (One data is missing i.e. "there is a light at the top of the pillar".)

$AB = 30\ ft$ is the pillar with a light at top.

If the emu ($CD = 8\ ft$) is walking away from the foot of the pillar,

It's shadow is infront of it's.

The length of the shadow of the emu is based on it's distance from the light pillar.

Let the distance x, y is as marked in the fig.

$\because AB \parallel CD$, Applying the basic proportionality theorem to the ΔEAB

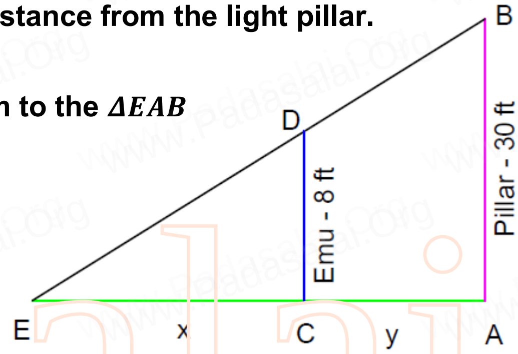
$\frac{EC}{EA} = \frac{CD}{AB} \rightarrow \frac{x}{x+y} = \frac{8}{30}$

$30x = 8x + 8y$

$22x = 8y$

$x = \frac{8y}{22} = \frac{4}{11} \times y$

Length of the shadow $= \frac{4}{11} \times$ *Distance of the emu from the pillar.*



9. Draw two circles C1 and C2 with are intersecting at A and B.

Marking a point P on the circle C1 and drawn a tangent XPY to it.

Join PA, PB which intersect circle C2 at C, D

Since the quadrilateral ABCD is a cyclic on circle C1

The sum of the opposite angles = 180°

Also *The exterior angle* $=$ *The interior angle*

$\therefore \angle PDC = \angle PBA$ ------- 1

$\angle PCD = \angle PAB$ ------- 2

Also XY is a tangent at P for circle C1

(Alternate segment angles are equal)

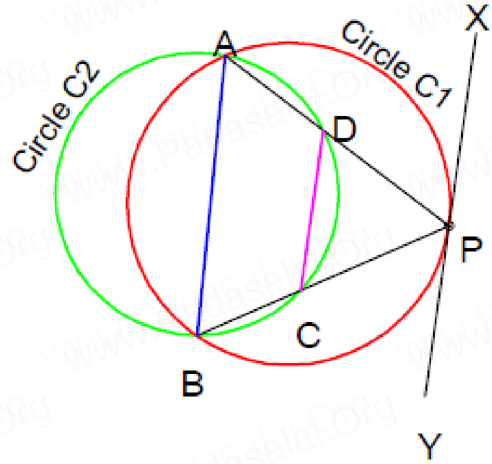
$\therefore \angle XPA = \angle PBA$ ------- 3

$\angle YPB = \angle PAB$ ------- 4

From 1 and 4, $\angle PDC = \angle YPB$

$\therefore$ According to the Alternate Segment Theorem,

CD is parallel to the tangent at P (Proved)



10. Given : $AD : DB = 5 : 3$; $BE : EC = 3 : 2$; $AC = 21$

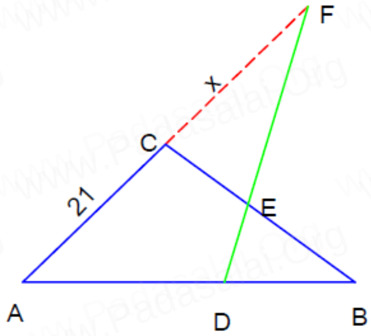
$\therefore\ \frac{AD}{DB} = \frac{5}{3}$; $\frac{BE}{EC} = \frac{3}{2}$

In ΔABC, D, E and F on AB, BC and CA (or their extension)

According to Menelaus theorem, for the collinearity of D, E and F

$\frac{AD}{DB} \times \frac{BE}{EC} \times \frac{CF}{FA} = -1$ (The line segments are with direction)

(Or) $\frac{AD}{DB} \times \frac{BE}{EC} \times \frac{FC}{FA} = 1$ (If any one of the line segments is changed with direction)



$\frac{5}{3} \times \frac{3}{2} \times \frac{FC}{FA} = 1$

$\frac{FC}{FA} = \frac{2}{5}$

$\frac{FC}{FC+CA} = \frac{2}{5}$

$\frac{FC}{FC+21} = \frac{2}{5}$

$5FC = 2FC + 42$

$5FC - 2FC = 42$

$3FC = 42$

$FC = \frac{42}{3} = 14$

10^{th} Maths Unit Exercise Chapter – 5 Coordinate Geometry

1. Given : PQRS is a rectangle,

Their points are $P(-1,-1),\ Q(-1,4),\ R(5,4)\ and\ S(5,-1)$

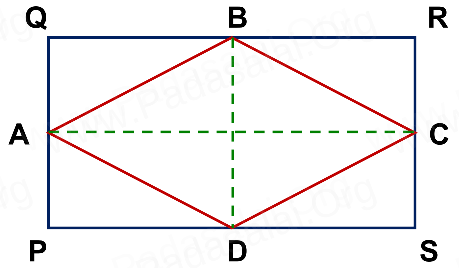
A, B, C and D are the mid-points of PQ, QR, RS and SP respectively.

(Hints to this problem :

1. For square, diagonals are equal and bisects perpendicular.
2. For rectangle, diagonals are equal and not bisects perpendicular.
3. For rhombus, diagonals are unequal but bisects perpendicular.

So finding the length of the diagonals and it's slopes will give the answer)

Using mid-point formula of $A = \left[\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right]$



$A = \left[\frac{(-1)+(-1)}{2}, \frac{(-1)+(4)}{2}\right] = \left(-1, \frac{3}{2}\right)$

$B = \left[\frac{(-1)+(5)}{2}, \frac{(4)+(4)}{2}\right] = (2, 4)$

$C = \left[\frac{(5)+(5)}{2}, \frac{(4)+(-1)}{2}\right] = \left(5, \frac{3}{2}\right)$

$D = \left[\frac{(5)+(-1)}{2}, \frac{(-1)+(-1)}{2}\right] = (2,-1)$

For the quadrilateral ABCD, AC and BD are the two diagonals.

The length of the diagonals

The distance between two points = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

Distance of $AC = \sqrt{(5-(-1))^2+\left(\frac{3}{2}-\frac{3}{2}\right)^2} = \sqrt{(5+1)^2+(0)^2} = 6$

Distance of $BD = \sqrt{(2-2)^2+((-1)-4)^2} = \sqrt{(0)^2+(-5)^2} = 5$

The Slopes of the diagonals

$Slope\ of\ AC = \left[\frac{y_2-y_1}{x_2-x_1}\right] = \left[\frac{\frac{3}{2}-\frac{3}{2}}{5-(-1)}\right] = \frac{0}{6} = 0$ i.e. $tan\emptyset = 0,\ \emptyset = 0°$

$Slope\ of\ BD = \left[\frac{y_2-y_1}{x_2-x_1}\right] = \left[\frac{-1-(-4)}{2-2}\right] = \frac{3}{0} = \infty$ i.e. $tan\emptyset = \infty,\ \emptyset = 90°$

∵Since the diagonals are unequal but bisecting perpendicular,

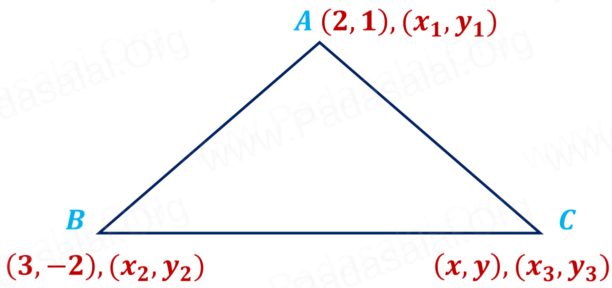
The quadrilateral ABCD is a Rhombus one.

2. Given : The area of the triangle = 5 sq.units, Two of its vertices are $A\ (2,1)$ and $B\ (3,-2)$.

Let the 3rd vertex be : $C\ (x,y)$, where $y = x+3$ ----- ①

Area of a triangle $= \frac{1}{2}\begin{Bmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{Bmatrix}$

$\frac{1}{2}\begin{Bmatrix} 2 & 3 & x & 2 \\ 1 & -2 & y & 1 \end{Bmatrix} = 5$



$(-4+3y+x)-(3-2x+2y) = 5\times 2$

$-4+3y+x-3+2x-2y = 10$

$3x+y-7 = 10$

$3x+y = 17$

From ① $3x+x+3 = 17$

$4x = 14$ (or) $x = \frac{14}{4} = \frac{7}{2},\ \ y = \frac{7}{2}+3 = \frac{13}{2}$

3. Given : Three straight lines

$3x+y-2 = 0$ ----- ① , $5x+2y-3 = 0$ ----- ② , $2x-y-3 = 0$ -----③

(Solving these three equations we can get the three vertices of a triangle.)

Taking ① and ②

$3x+y = 2 \rightarrow$ ①

$5x+2y = 3 \rightarrow$ ②

① $\times 2 \rightarrow 6x+2y = 4 \rightarrow$ ④

② − ④ $\rightarrow -x = -1$

$(or)\quad x = 1\,,\quad \therefore y = -1$

<u>Taking ② and ③</u>

$2x - y = 3 \rightarrow ③$

$5x + 2y = 3 \rightarrow ②$

$③ \times 2 \rightarrow 4x - 2y = 6 \rightarrow ⑤$

$② + ⑤ \rightarrow 9x = 9$

$(or)\quad x = 1\,,\quad \therefore y = -1$

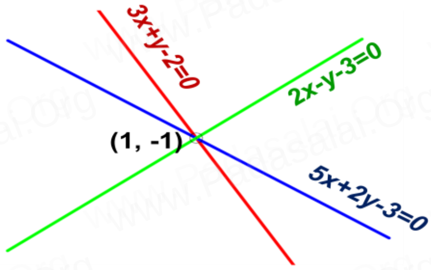
<u>Taking ③ and ①</u>

$2x - y = 3 \rightarrow ③$

$3x + y = 2 \rightarrow ①$

$① + ③ \rightarrow 5x = 5$

$(or)\quad x = 1\,,\quad \therefore y = -1$



Here the three points found out are the same. ∴ They are cocurrent.

Since the three lines are concurrent, there will be no triangle formed

∴The area of the triangle = 0

4. Given : Area of a quadrilateral = 72 sq.units

The vertices of the quadrilateral are $A(-5,7),\ B(-4,k),\ C(-1,-6),\ D(4,5)$

The area of a quadrilateral $= \frac{1}{2}\begin{Bmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{Bmatrix}$

$$\frac{1}{2}\begin{Bmatrix} -5 & -4 & -1 & 4 & -5 \\ 7 & k & -6 & 5 & 7 \end{Bmatrix} = 72$$

$$\{(-5k + 24 - 5 + 28) - (-28 - k - 24 - 25)\} = 72 \times 2$$

$$-5k + 47 + 77 + k = 144$$

$$-4k + 124 = 144$$

$$-4k = 144 - 124$$

$$k = \frac{20}{-4} = -5$$

5. Given : Four vertices $A(-2,-1),\ B(4,0),\ C(3,3)\ and\ D(-3,2)$

(Hint : If the slopes of the opposite sides are equal, they are parallel.)

(If so it's a parallelogram.)

$$Slope\ of\ a\ line\ (Two\ points) = \left[\frac{y_2-y_1}{x_2-x_1}\right]$$

$$Slope\ of\ line\ AB = \left[\frac{0-(-1)}{4-(-2)}\right] = \left[\frac{1}{4+2}\right] = \frac{1}{6}$$

$$Slope\ of\ line\ BC = \left[\frac{3-0}{3-4}\right] = \left[\frac{3}{-1}\right] = -3$$

$$Slope\ of\ line\ CD = \left[\frac{2-3}{(-3)-3}\right] = \left[\frac{-1}{-3-3}\right] = \frac{-1}{-6} = \frac{1}{6}$$

$$Slope\ of\ line\ DA = \left[\frac{(-1)-2}{(-2)-(-3)}\right] = \left[\frac{-3}{1}\right] = -3$$

$$Slope\ of\ line\ AB = Slope\ of\ line\ CD$$

$$Slope\ of\ line\ BC = Slope\ of\ line\ DA$$

Here the slopes of the opposite sides are equal, so they are parallel.

∴ The given points are the vertices of parallelogram.

6. Given : Sum of the intercepts = 1, Product of the intercepts = -6

Let a, b be the intercepts.

$a + b = 1\,,\quad ab = -6$

$b = 1 - a\,,\quad \therefore a(1 - a) = -6$

$$a - a^2 = -6$$
$$a^2 - a - 6 = 0$$
$$(a-3)(a+2) = 0 \text{ (or) } a = 3, -2$$

When $a = 3$, $b = 1 - a \longrightarrow 1 - 3 = -2$

When $a = -2$, $b = 1 - a \longrightarrow 1 - (-2) = 3$

Eqn. of the st. line for two intercept form $\frac{x}{a} + \frac{y}{b} = 1$

Eqn. of the st. line for the intercepts $= 3$, $b = -2$:

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

Multiplying with 6 (LCM of 3 and 2) on both sides,

$$\frac{6 \times x}{3} + \frac{6 \times y}{-2} = 1 \times 6$$
$$2x - 3y = 6 \ (or) \ 2x - 3y - 6 = 0$$

Eqn. of the st. line for the intercepts $= -2$, $b = 3$:

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

Multiplying with 6 (LCM of 3 and 2) on both sides,

$$\frac{6 \times x}{-2} + \frac{6 \times y}{3} = 1 \times 6$$
$$-3x + 2y = 6 \ (or) \ 3x - 2y + 6 = 0$$

The required eqns are : $2x - 3y - 6 = 0$

$3x - 2y + 6 = 0$

7. Given : 1st week price and quantity (A) $= (Rs.14, \ 980 \ litre) \ (x_1, y_2)$

2nd week price and quantity (B) $= (Rs.16, \ 1220 \ litre) \ (x_2, y_3)$

3rd week price and quantity (C) $= (Rs.17, \ x \ litre) \ (x_3, y_3)$

Relationship is linear. It means A, B and C are lie on the same line.

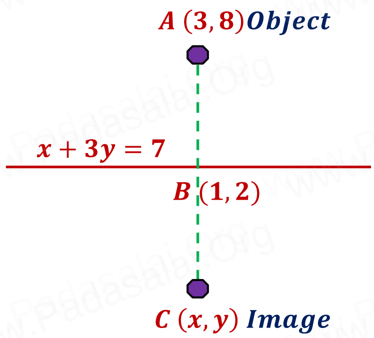
$$Slope \ of \ a \ line \ BC = Slope \ of \ a \ line \ AB$$
$$\left[\frac{y_3 - y_2}{x_3 - x_2}\right] = \left[\frac{y_2 - y_1}{x_2 - x_1}\right]$$
$$\left[\frac{x - 1220}{17 - 16}\right] = \left[\frac{1220 - 980}{16 - 14}\right]$$
$$x - 1220 = \left[\frac{240}{2}\right]$$
$$x = 120 + 1220 = 1340$$

The milk vendor sold 1340 lit milk at the rate of Rs.17 per lit on that week.

8. Given : The mirror of the line : $x + 3y = 7$, Object Point : $A\ (3, 8)$

To be found : Image point of the object.

(Hints : Object and it's image is always equidistant from the mirror perpendicularly.)



Mirror line : $x + 3y = 7$ ----- ①

The perpendicular line of the mirror : $3x - y + k = 0$ ----- ②

It passes through the object point : $A\ (3, 8)$

Placing the value of $A\ (3, 8)$ in ②

$3 \times 3 - 8 + k = 0$, $\therefore k = -1$

$\therefore$ The perpendicular eqn. is $3x - y - 1 = 0$

(Or) $3x - y = 1$ ----- ②

① $\times 3 \rightarrow 3x + 9y = 21$ ----- ③

② − ③ $\rightarrow -10y = -20$

$\therefore y = 2, \quad x = 1$ (This is midpoint of A and C)

Midpoint of $A(3, 8)$ and $C(x, y)$ is $B(1, 2)$

I.e. $\left(\frac{3+x}{2}, \ \frac{8+y}{2}\right) = (1, \ 2)$

$\frac{3+x}{2} = 1 \qquad \frac{8+y}{2} = 2$

$x = -1, \qquad y = -4$ ∴ The image point of the object is $(-1, -4)$

9. Given : $4x + 7y - 3 = 0$ and $2x - 3y + 1 = 0$

$4x + 7y = 3$ ------ ①

$2x - 3y = -1$ ------ ②

② $\times 2 \rightarrow 4x - 6y = -2$ ------ ③

① − ③ $\quad 13y = 5$ ------ ③ or $y = \frac{5}{13}$

Put $y = -\frac{5}{13}$ *in* ② $\rightarrow 2x - 3\left(\frac{5}{13}\right) = -1$

$2x - \frac{15}{13} = -1$

$2x = \frac{15}{13} - 1 = \frac{2}{13}$ (Or) $x = \frac{1}{13}$

The point of intersection is $\left(\frac{1}{13}, \frac{5}{13}\right)$

The required eqn. has equal intercepts. And let it be a, a

∴ $\frac{x}{a} + \frac{y}{a} = 1$ (or) $x + y = a$ And this is passes through the point of intersection $\left(\frac{1}{13}, \frac{5}{13}\right)$

$\frac{1}{13} + \frac{5}{13} = a$ (or) $a = \frac{6}{13}$

The required eqn. $x + y = a$

$x + y = \frac{6}{13}$ (or) $13x + 13y = 6$

10. Given : $2x - 3y + 4 = 0$ and $3x + 4y - 5 = 0$; 3rd eqn. $6x - 7y + 8 = 0$

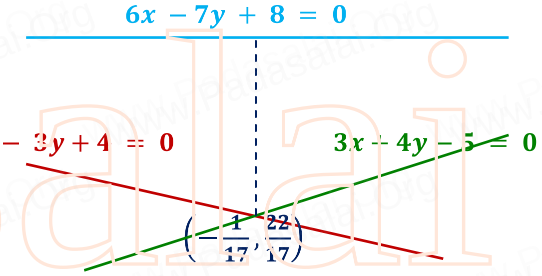
$2x - 3y = -4$ ------ ①

$3x + 4y = 5$ ------ ②

① $\times 3 \rightarrow 6x - 9y = -12$ ------ ③

② $\times 2 \rightarrow 6x + 8y = 10$ ------ ④

③ − ④ $\quad -17y = -22$ or $y = \frac{22}{17}$



Put $y = \frac{22}{17}$ *in* ① $\rightarrow 2x - 3\left(\frac{22}{17}\right) = -4$

$2x - \frac{66}{17} = -4$

$2x = \frac{66}{17} - 4 = \frac{66-68}{17} = -\frac{2}{17}$ Or $x = -\frac{1}{17}$

The point of intersection is $\left(-\frac{1}{17}, \frac{22}{17}\right)$

3rd eqn. $6x - 7y + 8 = 0$

The perpendicular of this eqn. which is passing through the point of intersection gives the shortest distance.

∴ The perpendicular eqn. of 3rd eqn. is $-7x - 6y + k = 0$

It passes through the point $\left(-\frac{1}{17}, \frac{22}{17}\right)$

$-7\left(-\frac{1}{17}\right) - 6\left(\frac{22}{17}\right) + k = 0$ ----- ①

① $\times 17 \rightarrow 7 - 132 + 17k = 0$

$17k = 125$ or $k = \frac{125}{17}$

The reuired eqn. is $-7x - 6y + \frac{125}{17} = 0$

Multiplying by 17, $-7x \times 17 - 6y \times 17 + \frac{125}{17} \times 17 = 0 \times 17$

$-119x - 102y + 125 = 0$ (Or) $119x + 102y - 125 = 0$

The required eqn. $119x + 102y - 125 = 0$

(Note : In the above all problems, linear equations with two variables are solved by elimination method. Students can follow their own method if feel easy.)

10th Maths Unit Exercise Chapter – 6 Trigonometry

1. (i) $LHS = cot^2A\left[\frac{sec\,A-1}{1+sin\,A}\right] + sec^2A\left[\frac{sin\,A-1}{1+sec\,A}\right]$

$$= \frac{cot^2A(sec\,A-1)(1+sec\,A)+sec^2A(sin\,A-1)(1+sin\,A)}{(1+sin\,A)(1+sec\,A)}$$

$$= \frac{cot^2A(sec\,A-1)(sec\,A+1)+sec^2A(sin\,A-1)(sin\,A+1)}{(1+sin\,A)(1+sec\,A)}$$

$$= \frac{cot^2A(sec^2A-1)+sec^2A(sin^2A-1)}{(1+sin\,A)(1+sec\,A)}$$

$$= \frac{cot^2A\times tan^2A+sec^2A\times(-cos^2A)}{(1+sin\,A)(1+sec\,A)}$$

$$= \frac{\frac{1}{tan^2A}\times tan^2A+\frac{1}{cos^2A}\times(-cos^2A)}{(1+sin\,A)(1+sec\,A)}$$

$$= \frac{1-1}{(1+sin\,A)(1+sec\,A)}$$

$$= \frac{0}{(1+sin\,A)(1+sec\,A)}$$

$= 0$

$= RHS$

(ii) $LHS = \frac{tan^2\theta-1}{tan^2\theta+1}$

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

$$= \frac{\frac{sin^2\theta-cos^2\theta}{cos^2\theta}}{\frac{sin^2\theta+cos^2\theta}{cos^2\theta}}$$

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

$$= \frac{sin^2\theta-cos^2\theta}{\cancel{cos^2\theta}} \times \frac{\cancel{cos^2\theta}}{1}$$

$= sin^2\theta - cos^2\theta$

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

$= 1 - 2cos^2\theta$

$= RHS$

2. $LHS = \left[\frac{1+sin\theta-cos\theta}{1+sin\theta+cos\theta}\right]^2$

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

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

$[(a+b+C)^2 = a^2+b^2+c^2+2ab+2bc+2ca]$

$$= \frac{1+1+2sin\theta-2sin\theta cos\theta-2cos\theta}{1+1+2sin\theta+2sin\theta cos\theta+2cos\theta}$$

$$= \frac{2-2cos\theta+2sin\theta-2sin\theta cos\theta}{2+2cos\theta+2sin\theta+2sin\theta cos\theta}$$

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

$$= \frac{(1-cos\theta)(\cancel{2+2sin\theta})}{(1+cos\theta)(\cancel{2+2sin\theta})}$$

$$= \frac{(1-cos\theta)}{(1+cos\theta)}$$

$= RHS$

3. Given : $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ ------- ①

$$x\sin\theta = y\cos\theta \quad \text{-------------} ②$$

From ② → $x = \frac{y\cos\theta}{\sin\theta}$ ------------- ③

Put ③ in ① → $\frac{y\cos\theta}{\sin\theta}\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$

$$y\cos\theta\sin^2\theta + y\cos^3\theta = \sin\theta\cos\theta$$

$$y\cos\theta(\sin^2\theta + \cos^2\theta) = \sin\theta\cos\theta$$

$$y\cos\theta(1) = \sin\theta\cos\theta$$

$$y = \frac{\sin\theta\cos\theta}{\cos\theta} = \sin\theta$$

$$\therefore \textit{From } ③ \quad x = \frac{\sin\theta\cos\theta}{\sin\theta} = \cos\theta$$

$$x^2 + y^2 = \sin^2\theta + \cos^2\theta$$

$\therefore x^2 + y^2 = 1$ **(Proved)**

4. Given : $a\cos\theta - b\sin\theta = c$

Squaring on both sides → $(a\cos\theta - b\sin\theta)^2 = c^2$

$$a^2\cos^2\theta + b^2\sin^2\theta - 2ab\sin\theta\cos\theta = c^2$$

$$a^2(1-\sin^2\theta) + b^2(1-\cos^2\theta) - 2ab\sin\theta\cos\theta = c^2$$

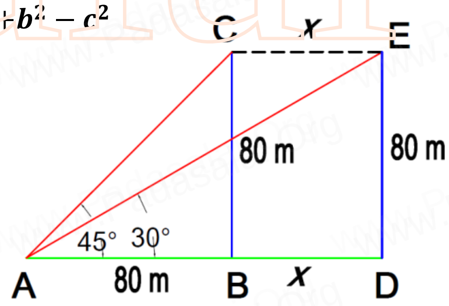
$$a^2 - a^2\sin^2\theta + b^2 - b^2\cos^2\theta - 2ab\sin\theta\cos\theta = c^2$$

$$-a^2\sin^2\theta - b^2\cos^2\theta - 2ab\sin\theta\cos\theta = -a^2 - b^2 + c^2$$

$$a^2\sin^2\theta + b^2\cos^2\theta + 2ab\sin\theta\cos\theta = a^2 + b^2 - c^2$$

$$(a\sin\theta + b\cos\theta)^2 = a^2 + b^2 - c^2$$

Taking square root on both sides, $a\sin\theta + b\cos\theta = \pm\sqrt{a^2+b^2-c^2}$



5. Let the bird is sitting initially at C which is 80 m high.

The angle of elevation of C, i.e. $\angle BAC = 45°$

$$\tan 45° = \frac{BC}{AB}$$

$$1 = \frac{80}{AB} \; ; \quad \therefore AB = 80\,m$$

Then the bird is flying horizontally $x\,m$ from C to the point E for 2 seconds.

$$CE = BD = x\,m$$

Now the angle of elevation of E i.e. $\angle DAE = 30°$

$$\tan 30° = \frac{DE}{AD} = \frac{DE}{AB+BD}$$

$$\frac{1}{\sqrt{3}} = \frac{80}{80+x}$$

$$80 + x = \sqrt{3}\times 80$$

$$x = \sqrt{3}\times 80 - 80$$

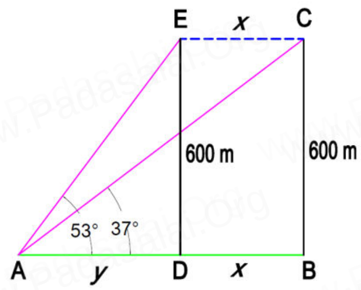
$$x = 80(\sqrt{3}-1) = 80(1.732-1)$$

$$x = 80 \times 0.732 = 58.56\,m$$

Distance travelled by the bird $x = 58.56\,m$; Time taken for it = 2 seconds

$$Speed = \frac{Distance\ travelled}{Time\ taken} = \frac{58.56}{2} = 29.28\,m/\,second.$$

6. Let the plane be at C initially which is 600 m high.



The angle of elevation $\angle BAC = 37°$

$$tan37° = \frac{BC}{AB}$$

$$0.7536 = \frac{600}{x+y} \;;$$

$$\therefore x + y = \frac{600}{0.7536} = 796.18\, m$$

Then the plane is flying horizontally $x\, m$ to the point E.

$$CE = BD = x\, m$$

Now the angle of elevation $\angle DAE = 53°$; DE = BC = 600 m

$$tan53° = \frac{DE}{AD}$$

$$1.3270 = \frac{600}{y}$$

$$y = \frac{600}{1.327} = 452.15\, m$$

$$x + y = 796.18\, m$$

$$x = 796.18 - y$$

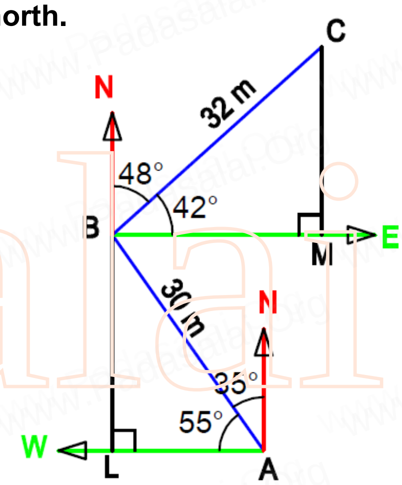
$$x = 796.18 - 452.15 = 344.03\, m$$

Distance travelled by the plane $x = 344.03\, m$; Speed of the plane = 175 m/seconds

$$Time\ taken = \frac{Distance\ travelled}{Speed} = \frac{344.03}{175} = 1.97\ second.$$

7. The bird is flying from A to B at an angle of 35° with respect to north.

$AB = 30\, m$; $\angle LAB = 90° - 35° = 55°$



<u>In the right angled triangle ALB</u>

$sin\ 55° = \frac{LB}{AB}$;	$cos\ 55° = \frac{AL}{AB}$
$0.8192 = \frac{LB}{30}$;	$0.5736 = \frac{AL}{30}$
$LB = 0.8192 \times 30$;	$AL = 0.5736 \times 30$
$LB = 24.58\, m$;	$AL = 17.21\, m$

Now the bird is flying from B to C at an angle of 48° with respect to north. $BC = 32\, m$; $\angle MAC = 90° - 48° = 42°$

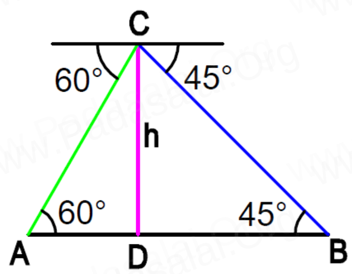
<u>In the right angled triangle BMC</u>

$sin\ 42° = \frac{MC}{BC}$	$cos\ 42° = \frac{BM}{BC}$
$0.6691 = \frac{MC}{32}$	$0.7431 = \frac{BM}{32}$
$MC = 0.6691 \times 32$	$BM = 0.7431 \times 32$
$MC = 21.41\, m$	$BM = 23.78\, m$

(i) *B is* $24.58\, m$ *from North of A* (*i.e.* LB) (ii) *B is* $17.21\, m$ *from West of A* (*i.e.* AL)

(iii) *C is* $21.41\, m$ *from North of B* (*i.e.* MC) (iv) *C is* $23.78\, m$ *from East of B* (*i.e.* BM)

8. Let A and B be the two ships on either side of the light house CD



Distance between two ships $AB = 200\left[\frac{\sqrt{3}+1}{\sqrt{3}}\right]\, m$

The angle depressions from the top light house are $60°$ *and* $45°$

∴ The angle of elevation from A is 60°

The angle of elevation from B is 45°

Let the height of light house CD be $h\, m$

From the rt. Triangle ADC, $tan\ 60° = \frac{h}{AD}$

$$\sqrt{3} = \frac{h}{AD} \qquad \therefore AD = \frac{h}{\sqrt{3}}$$

From the rt. Triangle BDC, $tan\ 45° = \frac{h}{BD}$

$$1 = \frac{h}{BD} \qquad \therefore BD = h$$

$$AD + BD = \frac{h}{\sqrt{3}} + h$$

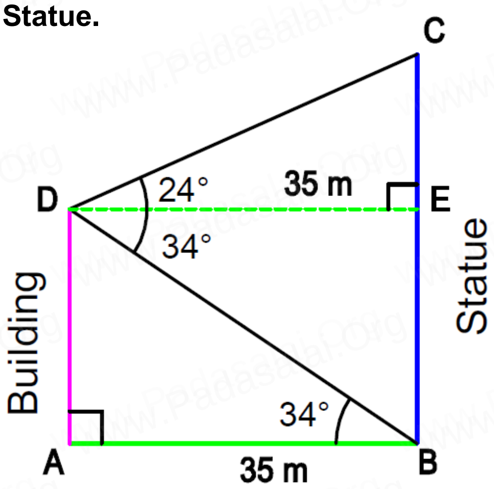
$$AB = h\left[\frac{1}{\sqrt{3}} + 1\right]$$

$$200\left[\frac{\sqrt{3}+1}{\sqrt{3}}\right] = h\left[\frac{\sqrt{3}+1}{\sqrt{3}}\right]$$

$$\therefore h = 200\ m$$

Hieght of the light house $= 200\ m$

9. Width of the street $= 35\ m$; AD is the Buiding ; BC is the Statue.
From the top of the building ,
The angle of elevation of the top of the statue $= 24°$
The angle of depression of the top of the statue $= 34°$
∴The angle of elevation of the top of the building $= 34°$



In the $right\ \Delta\ BAD$, $tan34° = \frac{AD}{AB}$

$$0.6745 = \frac{AD}{35}$$

$$AD = 35 \times 0.6745 = 23.61\ m$$

$$\therefore BE = AD = 23.61\ m$$

In the $right\ \Delta\ DEC$, $tan24° = \frac{EC}{DE}$

$$0.4452 = \frac{EC}{35}$$

$$EC = 35 \times 0.4452 = 15.58\ m$$

$$Height\ of\ the\ statue = BE + EC$$
$$= 23.61 + 15.58$$
$$= 39.19\ m.$$

Hieght of the Statue $= 39.19\ m$

10^{th} Maths Unit Exercise Chapter – 7 Mensurattion.

1. Given : Pen's Cylindrical barrel length = 7 cm ; Dia. = 5 mm (or) 0.5 cm ; ∴Radius = 0.25 cm
Volume of the ink bootle = $1/5^{th}$ of 1 litre ; Number of words written in 1 barrel = 330

$$Vol.\,of\ Cylindrical\ barrel = \pi r^2 h = \frac{22}{7} \times o.25 \times 0.25 \times 7 = 22 \times 0.25 \times 0.25\ cm^3$$

$$Vol.\,of\ ink\ bottle = \frac{1}{5}^{th}\ of\ \ 1\ lit. = \frac{1}{5} \times 1000 = 200\ ml\ or\ 200\ cm^3$$

Number of barrels to be filled up $= \frac{Vol.of\ ink\ bottle}{Vol.of\ 1\ Cylindrical\ barrel} = \frac{200}{22\times0.25\times0.25}$

Number of words to be written $= Number\ of\ barrels\ \times Number\ of\ words\ written\ in\ 1\ barrel$

$$= \frac{200}{22\times0.25\times0.25} \times 330 = \frac{200\times100\times100}{22\times25\times25} \times 330 = 48000$$

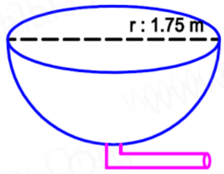
Number of words written using the ink in the bottle = 48000

2. Given : Radius of the hemispherical tank = 1.75 m ; Emptying speed of the pipe = 7 lit. per second

$$Vol.\,of\ hemisperical\ tank = \frac{2}{3}\pi r^3 = \frac{2}{3} \times \frac{22}{7} \times 1.75^3\ m^3\ (or) \frac{2}{3} \times \frac{22}{7} \times 1.75^3 \times 1000\ lit.$$

$$Time\ taken\ to\ empty\ the\ tank = \frac{Vol.of\ hemisperical\ tank}{Emptying\ speed\ of\ the\ pipe}$$

$$= \frac{2}{3} \times \frac{22}{7} \times \frac{1.75\times1.75\times1.75\times1000}{7} = 1604\ secods$$

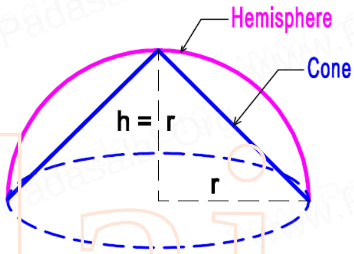


$$Time\ taken\ to\ empty\ the\ tank = 1604\ seconds\ \ (Or) \frac{1604}{60} = 26\ min\ 44\ sec.$$

3. Given : Solid hemisphere of radius = r

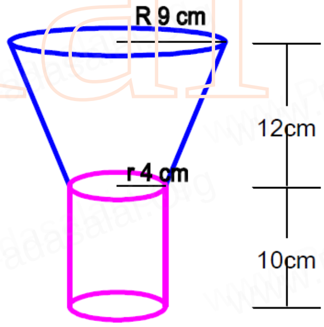
It's Volume $= \frac{2}{3}\pi r^3$

Radius of the cone maximum carved from it = r unit
Height of the cone maximum carved from it also = r unit



$$Maximum\ Vol.\,of\ the\ Cone = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r^2 r = \frac{1}{3}\pi r^3\ cubic\ units.$$

4. Given : Cylinder portion dia = 8 cm ; ∴ r = 4 cm ; h = 10 cm
Frustum portion d = 8 cm ; ∴ r = 4 cm ;
D = 18 cm ; ∴ R = 9 cm ; h = 12 cm



Frustum's Slant height $= \sqrt{(R-r)^2 + h^2} = \sqrt{5^2 + 12^2} = 13\ cm$

CSA of funnel $= 2\pi rh + \pi(R+r)l = \pi[2rh + (R+r)l]$

$$= \pi[2 \times 4 \times 10 + (9+4)13]$$
$$= \pi[80 + 169]$$
$$= \frac{22}{7} \times 249 = 782.57\ cm^2$$

Sheet required to funnel $= 782.57\ cm^2$

5. Given : Coin dia = 1.5 cm ; ∴ r = 0.75 cm ; Thickness (h) = 2 mm (or) 0.2 cm
Cylinder dia = 4.5 cm ; ∴ r = 2.25 cm ; Height (h) = 10 cm

Volume of a coin $= \pi r^2 h = \pi \times 0.75^2 \times 0.2\ cm^3$

Volume of the cylinder $= \pi r^2 h = \pi \times 2.25^2 \times 10\ cm^3$

Number of coins required to the cylinder $= \frac{Volume\ of\ the\ cylinder}{Volume\ of\ a\ coin}$

$$= \frac{\pi\times2.25\times2.25\times10}{\pi\times0.75\times0.75\times0.2} = \frac{\cancel{\pi}\times\overset{3}{\cancel{225}}\times\overset{3}{\cancel{225}}\times\overset{50}{\cancel{100}}}{\cancel{\pi}\times\cancel{75}\times\cancel{75}\times\cancel{2}} = 450$$

Number of coins required to the cylinder = 450

6. Given : Hollow Cylinder R = 4.3 cm ; r = 1.1 cm ; Height (h) = 4 cm
Solid Cylinder Height (h) = 12 cm ; r = ?

Volume of the Hollow Cylinder $= \pi h(R+r)(R-r) = \pi \times 4 \times (4.3 + 1.1)(4.3 - 1.1)$

Volume of the Solid cylinder $= \pi r^2 h = \pi \times \mathrm{r}^2 \times 10$

Volume of the Solid cylinder = Volume of the Hollow Cylinder

$$\pi \times r^2 \times 12 = \pi \times 4 \times (4.3 + 1.1)(4.3 - 1.1)$$

$$\cancel{\pi} \times r^2 \times 12 = \cancel{\pi} \times 4 \times 5.4 \times 3.2$$

$$r^2 = \frac{4 \times 5.4 \times 3.2}{12} = \sqrt{1.8 \times 3.2}$$

$$r = \sqrt{5.76} = 2.4\ cm$$

Diameter of the Solid cylinder $= 2r = 2 \times 2.4 = 4.8\ cm$

7. Given : Frustum cone Slant height = 4 m ; Perimeters = 16 m, 18 m

∴ It's radii $r = \frac{P}{2\pi} = \frac{16}{2\pi} = \frac{8}{\pi}$; $R = \frac{P}{2\pi} = \frac{18}{2\pi} = \frac{9}{\pi}$

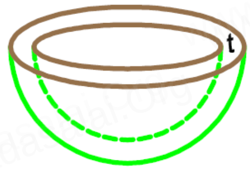
CSA of funnel $= \pi(R + r)l = \pi\left(\frac{9}{\pi} + \frac{8}{\pi}\right)4 = \pi\left(\frac{9+8}{\pi}\right)4 = 17 \times 4 = 68\ m^2$

Rate of Painting = Rs. 100 per sq.m

Cost of Painting = 68 X 100 = Rs. 6800

8. Given : Hemi-spherical hollow bowl : External dia. = 14 cm ; ∴ R = 7 cm

It's material volume $= \frac{436\pi}{3}\ cm^3$



It's material volume $= \frac{2\pi(R^3 - r^3)}{3} = \frac{436\pi}{3}$

$$7^3 - r^3 = \frac{436}{2} = 218$$

$$343 - r^3 = 218$$

$$-r^3 = 218 - 343$$

$$r^3 = -218 + 343 = 125$$

$$r = \sqrt[3]{125} = 5\ cm$$

Thickness of the bowl : (R – r) = 7 – 5 = 2 cm

9. Given : Volume of a cone $= 1005\frac{5}{7}\ cm^3$; **It's base area** $= 201\frac{1}{7}\ cm^2$; **Slant height of cone = ?**

Base Area $= \pi r^2 = 201\frac{1}{7}$; $\frac{22}{7}r^2 = \frac{1402}{7}$

$$r^2 = \frac{1408}{22} = 64$$

$$r = \sqrt{64} = 8\ cm$$

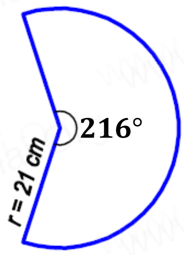
It's volume $= \frac{1}{3}\pi r^2 h = 1005\frac{5}{7}$; $\frac{1}{3} \times \frac{22}{7} \times 8 \times 8 \times h = \frac{7040}{7}$

$$h = \frac{7040 \times 3}{22 \times 8 \times 8} = 15\ cm$$

Slant height of cone $= \sqrt{r^2 + h^2} = \sqrt{8^2 + 15^2} = \sqrt{64 + 225} = \sqrt{289} = 17\ cm$

10. Given : Segment of a circular sheet Radius r = 21 cm

It's central angle angle $x = 216°$



It's arc length $= \frac{x}{360} \times 2\pi r = \frac{216}{360} \times 2\pi \times 21$

Perimeter of the cone formed = Arc length of the segment

$$2\pi r = \frac{216}{360} \times 2\pi \times 21$$

$$r = \frac{63}{5}\ cm$$

Slant height of the cone = Radius of the segment ; $\therefore l = 21\ cm$

Height of the cone $= \sqrt{l^2 - r^2} = \sqrt{21^2 - \left[\frac{63}{5}\right]^2} = \sqrt{441 - \frac{3969}{25}} = \sqrt{\frac{441 \times 25 - 3969}{25}} = \sqrt{\frac{7056}{25}} = \frac{84}{5}\ cm$

Volume of the cone $= \frac{1}{3}\pi r^2 h = \frac{1}{\cancel{3}} \times \frac{22}{\cancel{7}} \times \frac{\overset{3}{\cancel{63}}}{5} \times \frac{63}{5} \times \frac{84}{5} = \frac{349272}{125} = 2794.18\ cm^3$

10th Maths Unit Exercise Chapter – 8 Mensurattion.

1. Given : The data and the frequency table:

Class Interval	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 - 120
Frequency	5	f_1	10	f_2	7	8

Sum of all frequencies $= 5 + f_1 + 10 + f_2 + 7 + 8 = f_1 + f_2 + 30 = 50$

$f_1 + f_2 = 50 - 30 = 20$; $\therefore f_1 = 20 - f_2$ ------- (1)

Class Mid value : 10 30 50 70 90 110

Class mean $= \frac{10\times5+30\times f_1+50\times10+70\times f_2+90\times7+110\times8}{50} = 62.8$

$50 + 30f_1 + 500 + 70f_2 + 630 + 880 = 62.8 \times 50$

Dividing by 10 on both sides : $5 + 3f_1 + 50 + 7f_2 + 63 + 88 = 62.8 \times 5$

$3f_1 + 7f_2 + 216 = 314$

$3f_1 + 7f_2 = 314 - 216 = 108$

From (1) $\rightarrow$ $3(20 - f_{2)} + 7f_2 = 108$

$4f_2 = 108 - 60 = 48$;

$f_2 = \frac{48}{4} = 12$; $f_1 = 20 - 12 = 8$

2. Given : The data and the frequency table:

Diameters	33 – 36	37 – 40	41 – 44	45 – 48	49 – 52
Number of circles	15	17	21	22	25

The continuous frequency $= 32.5 - 36.5,\ 36.5 - 40.5,\ 40.5 - 44.5,\ 44.5 - 48.5,\ 48.5 - 52.5$

The Midvalue $= 34.5,\ 38.5,\ 42.5,\ 46.5,\ 50.5$

Let the assumed mean A = 42.5 and C = 4

Diameters	Midvalue	fi	$d_i = \frac{x_i - A}{c}$	d_i^2	f_id_i	$f_id_i^2$
$32.5 - 36.5$	34.5	15	−2	4	−30	60
$36.5 - 40.5$	38.5	17	−1	1	−17	17
$40.5 - 44.5$	42.5	21	0	0	0	0
$44.5 - 48.5$	46.5	22	1	1	22	22
$48.5 - 52.5$	50.5	25	2	4	50	100
		N=100	$\sum d_i = 0$		$\sum f_id_i = 25$	$\sum f_id_i^2 = 199$

Standard Deviation σ = C $\times \sqrt{\frac{\sum f_id_i^2}{N} - \left(\frac{\sum f_id_i}{N}\right)^2}$

$= 4 \times \sqrt{\frac{199}{100} - \left(\frac{25}{100}\right)^2}$

$= 4 \times \sqrt{1.99 - \left(\frac{1}{4}\right)^2}$

$= 4 \times \sqrt{\frac{1.99\times16-1}{16}}$

$= 4 \times \frac{\sqrt{31.84-1}}{\sqrt{16}} = 4 \times \frac{\sqrt{30.84}}{4} = 5.55$

The SD $\sigma = 5.55$

3. Given : Variance $\sigma^2 = 160$; The data and the frequency table:

x	k	k	$3k$	$4k$	$5k$	$6k$
f	2	1	1	1	1	1

Using direct method

x	f	f_ix_i	$(f_ix_i)^2$
k	2	$2k$	$4k^2$
$2k$	1	$2k$	$4k^2$
$3k$	1	$3k$	$9k^2$
$4k$	1	$4k$	$16k^2$
$5k$	1	$5k$	$25k^2$
$6k$	1	$6k$	$36k^2$
	$\sum f_i = 7$	$\sum(f_ix_i) = 22k$	$\sum(f_ix_i)^2 = 92k^2$

Standard Deviation σ = $\sqrt{\frac{\sum f_i x_i^2}{\sum f_i} - \left(\frac{\sum f_i x_i}{\sum f_i}\right)^2}$

Variance $\sigma^2 = \frac{\sum f_i x_i^2}{\sum f_i} - \left(\frac{\sum f_i x_i}{\sum f_i}\right)^2$

$$\frac{92k^2}{7} - \left(\frac{22k}{7}\right)^2 = 160$$

$$\frac{92k^2 \times 7 - (22k)^2}{7\times 7} = 160$$

$$\frac{644k^2 - 484k^2}{7\times 7} = 160$$

$$\frac{160k^2}{7\times 7} = 160 \ ;$$

$$k^2 = 49 \quad \text{(Or)} \quad k = 7$$

4. Given : The SD of some temperature data in degree Celsius (°C) = 5

Celsius(°C) to Farenheit (°F) conversion $= \frac{9}{5} \times$ °C $+ 32$

∴ The SD of that temperature datas in Farenheit (°F) $= \frac{9}{5} \times 5 = 9$ *[Leaving the addl. constant of 32]*

It's variance $\sigma^2 = 9^2 = 81$

5. Given : $\sum(x-5) = 3$; i.e. $\sum d_i = 3$; Number of datas $n = 18$

$\sum(x-5)^2 = 43$; i.e. $\sum d_i^2 = 43$

$$SD = \sqrt{\frac{\sum d_i^2}{n} - \left(\frac{\sum d_i}{n}\right)^2} = \sqrt{\frac{43}{18} - \left(\frac{3}{18}\right)^2}$$

$$= \sqrt{\frac{43\times 18 - 9}{18^2}}$$

$$= \sqrt{\frac{765}{18^2}} = \frac{\sqrt{765}}{\sqrt{18^2}} = \frac{27.66}{18} = 1.54$$

6. Prices in city A : 20, 22, 19, 23, 16

Prices in city B : 10, 20, 18, 12, 15

$$Mean\ of\ A = \frac{20+22+19+23+16}{5} = 20 \ ; \quad Mean\ of\ B = \frac{10+20+18+12+15}{5} = 15$$

To find SD for city A

x_i	$d_i = x_i - \bar{x}$ $= x_i - 20$	d_i^2
20	0	0
22	2	4
19	−1	1
23	3	9
16	−4	16
		20

To find SD for city B

x_i	$d_i = x_i - \bar{x}$ $= x_i - 15$	d_i^2
10	−5	25
20	5	25
18	3	9
12	−3	9
15	0	0
		68

SD of A (σ) = $\sqrt{\frac{\sum d_i^2}{n}} = \sqrt{\frac{30}{5}} = \sqrt{6} = 2.45$

SD of B (σ) = $\sqrt{\frac{\sum d_i^2}{n}} = \sqrt{\frac{68}{5}} = \sqrt{13.6} = 3.69$

C.V of A = $\frac{\sigma}{\bar{x}} \times 100 = \frac{2.45}{20} \times 100$ = 12.25 ------------- ①

C.V of B = $\frac{3.69}{15} \times 100$ = 24.6 ------------- ②

Comparing ① and ② **City A is more consistent.**

7. Given : Range : $L - S = 20$; Coefficient : $\frac{L-S}{L+S} = 0.2$

$\frac{20}{L+S} = 0.2$ (or) $L + S = \frac{20}{0.2} = \frac{200}{2} = 100$

$L - S = 20$ ------ ①

$L + S = 100$ ------- ②

Adding ① *and* ② $\rightarrow 2L = 120$; $L = 60$; $S = 100 - 60 = 4$

8. Two dice are rolled.

Then it's Sample space = {(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)}

n(S) = 36

(i). Let A be the event of getting the product value is 6

$A = \{(2,3),(3,2),(1,6),(6,1)\}$; $n(A) = 4$

$P(A) = \frac{n(A)}{n(S)} = \frac{4}{36}$

(ii). Let B be the event of getting a product as a prime number

$B = \{(1,6),(6,1)\}$; $n(A) = 6$

$P(B) = \frac{n(B)}{n(S)} = \frac{2}{36}$

Also $(A \cap B) = \{(1,6),(6,1)\}$; $n(A \cap B) = 2$

$P(A \cap B) = \frac{n(A \cap B)}{n(S)} = \frac{2}{36}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A \cup B) = \frac{4}{36} + \frac{2}{36} - \frac{2}{36} = \frac{4}{36} = \frac{1}{9}$

$\left.\begin{array}{r}\textit{Probability of getting the product of face value 6} \\ \textit{or the difference of face values 5.}\end{array}\right\} = \frac{1}{9}$

9. Given : A family with 2 children

The Sample space of the family $= \{(F, M, B, B), (F, M, B, G), (F, M, G, G)\}$; $n(S) = 3$

Let A be the event of at least one girl

$$A = \{(F, M, B, G), (F, M, G, G)\} ; \quad n(A) = 2$$

$$P(A) = \frac{n(A)}{n(S)} = \frac{2}{3}$$

The probability for at least one girl in the family $= \frac{2}{3}$

10. Given : A bag contains 5 white balls

Let the number of black balls $= x$; $n(S) = x + 5$

Probability of getting a black ball $P(A) = \frac{x}{x+5}$ ------- ①

Probability of getting a white ball $P(B) = \frac{5}{x+5}$ ------- ②

As per condition , ① $= 2 \times$ ②

$$\frac{x}{\cancel{x+5}} = 2 \times \frac{5}{\cancel{x+5}}$$

$$x = 2 \times 5 = 10$$

Number of black balls in the bag = 10

11. Given : Probability of passing the English examination : $P(E) = 0.75$

Probability of passing in both English and Tamil : $P(E \cap T) = 0.5$

Probability of passing neither : $P(\overline{E \cup T}) = 0.1$

∴ Probability of passing either : $P(E \cup T) = 1 - 0.1 = 0.9$

Also, $P(E \cup T) = P(E) + P(T) - P(E \cap T)$

$$0.9 = 0.75 + P(T) - 0.5$$

$$P(T) = 0.9 + 0.5 - 0.75 = 0.65$$

Probability of passing in Tamil $= 0.65$

12. Total cards in a deck = 52

Cards removed in spade is King, Queen and Jack = 3

Remaining cards for selection : $n(S) = 52 - 3 = 49$

(i). <u>Probability of getting a diamond</u>

Number of diamond cards in the list of selection : $n(A) = 13$

Probability of getting a diamond $P(A) = \frac{n(A)}{n(S)} = \frac{13}{49}$

(ii). <u>Probability of getting a queen</u>

Number of queen cards in the list of selection : $n(B) = 4 - 1 = 3$

Probability of getting a queen $P(B) = \frac{n(B)}{n(S)} = \frac{3}{49}$

(iii). <u>Probability of getting a spade</u>

Number of spade cards in the list of selection : $n(C) = 13 - 3 = 10$

Probability of getting a spade : $P(C) = \frac{n(C)}{n(S)} = \frac{10}{49}$

(iv) <u>Probability of getting a heart card bearing the number 5</u>.

Number of heart card bearing 5 in the list of selection : $n(D) = 1$

Probability of getting a heart card bearing the number 5 : $P(D) = \frac{n(D)}{n(S)} = \frac{1}{49}$

10 கணிதம் - புள்ளியியல்

வர்க்கமூலம் காண உதவும் சூத்திரம்..

- Very useful
- Simple
- Accurate.

$$\boxed{\sqrt{x \pm y} = \sqrt{x} \pm \frac{y}{2\sqrt{x}}}$$

THANKS TO...
MR. SREEDHARAN,
Kancheepuram.

① எடுத்துக்காட்டு - 8.4:

$\sqrt{8} = \sqrt{9-1}$

$\sqrt{x-y} = \sqrt{x} - \frac{y}{2\sqrt{x}}$

$x=9,\ y=1 \Rightarrow \sqrt{9-1} = \sqrt{9} - \frac{1}{2\sqrt{9}}$

$= 3 - \frac{1}{2\times 3} = 3 - \frac{1}{6}$

$= 3 - 0.166 = 2.834$

Book Answer: $\sigma \simeq 2.83$

② எ.கா. 8.5:

$\sqrt{3.53} = \sqrt{\underset{(x)}{9} - \underset{(y)}{0.47}} = \sqrt{9} - \frac{0.47}{2\sqrt{9}}$

$= 3 - \frac{0.47}{6}$

$= 3 - 0.078 = 2.92$

Book $\simeq$ 2.9

③ எ.கா: 8.6.

$\sqrt{44.49} = \sqrt{\underset{x}{49} - \underset{y}{4.51}} = 7 - \frac{4.51}{2\times 7}$

$= 7 - 0.32 = 6.68$

Book $\simeq$ 6.67

④ எ.கா: 8.7

$\sqrt{5.5 - 0.25} = \sqrt{5.25} = \sqrt{\underset{x}{4} + \underset{y}{1.25}}$

$= 2 + \frac{1.25}{2\times 2} = 2 + 0.31$

$\simeq 2.31$

Book. $\simeq$ 2.29

⑤ எ.கா.: 8.8.

$\sqrt{6} = \sqrt{\underset{x}{4} + \underset{y}{2}}$

$= 2 + \frac{2}{2\times 2} = 2.5$

Book $\simeq$ 2.45

⑥ எ.கா. 8.9:

$\sqrt{5.2} = \sqrt{\underset{x}{4} + \underset{y}{1.2}} = 2 + \frac{1.2}{2\times 2}$

$= 2 + 0.3 = 2.3$

Book $\simeq$ 2.28

⑦ எ.கா. 8.11:

$\sqrt{2.58} = \sqrt{\underset{x}{4} - \underset{y}{1.42}}$

$= 2 - \frac{1.42}{2\times 2} = 2 - 0.355$

$= 1.645$

Book $\simeq$ 1.6

⑧ எ.கா: 8.13:

$\sqrt{2.779} = \sqrt{\underset{x}{4} - \underset{y}{1.221}} = 2 - \frac{1.221}{2\times 2}$

$= 2 - 0.305 = 1.695$

Book: 1.667

⑨ எ.கா: 8.14:

$\sqrt{35} = \sqrt{\underset{x}{36} - \underset{y}{1}} = 6 - \frac{1}{2\times 6}$

$= 6 - 0.083 = 5.917$

Book → 5.9

⑩ எ.கா: 8.17

$\sqrt{19.43 - 18.40} = \sqrt{1.03} = \sqrt{\underset{x}{1} + \underset{y}{0.03}}$

$= 1 + \frac{0.03}{2} = 1.015$

1.01 Book

$\sqrt{26.29 - 18.40} = \sqrt{7.89} = \sqrt{\underset{x}{9} - \underset{y}{1.11}}$

$= 3 - \frac{1.11}{6} = 3 - 0.183$

$= 2.817$

Book: 2.81

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