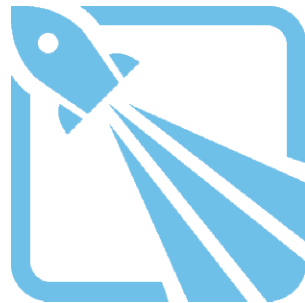


IIST

IIT FOUNDATION

Integrated Syllabus

TEACHER'S HAND BOOK



MATHEMATICS

CLASS VIII

INDIAN INSTITUTE OF SOFTWARE TECHNOLOGY

C O N T E N T S

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Exercise - 1



I. Choose the correct answer.

- Ans : 1. A - 9 2. B - $\frac{n(n+1)}{2}$ 3. C - rational number
 4. D - none of these (because it is an irrational no.) 5. B - real numbers
 6. A - imaginary 7. B - two 8. B - even 9. B - odd

Application Skill Achiever



I. Choose the correct answer.

$$1. \quad 37^{62} - 23^{62} = (37^{31})^2 - (23^{31})^2 \\ = (37^{31} + 23^{31})(37^{31} - 23^{31})$$

So it is divisible by $37 + 23$ and $37 - 23$

So the number is divisible by $60 \times 14 = 840$ **Ans: (b)**

2. We get a zero at the end of a number when we multiply that Number of zeros at the end of $100!$, we have to find the highest Power of 10 present in the number. Since $10 = 2 \times 5$ we have to Find the highest power of 5 in $100!$

$$\text{The highest power of 5 in } 100! = \frac{100}{5} + \frac{100}{25} = 24$$

$$\text{The highest power of 5 in } 99! = \frac{99}{5} + \frac{99}{25} = 19 + 3 = 22$$

So answer is such a number does not exist (**Ans: D**)

3. According to Wilsons theorem if p is a prime number $(p - 1)! + 1$ Is divisible by p so here 23 is a prime number so $22! + 1$ is Divisible by 23. (**Ans: A**)

4. **Ans - (d) - 7**

5. The expression $333^{555} + 555^{333}$ is divisible by 3 Because 333 and 555 both are divisible by 3

6. **Ans : (b) - > 1**

7. **Ans : (b) - 75**

8. **Ans : (d) - 6 and 12**

Because $6 + 6n = 6n(n+1)$ if $n = 1$ then $n + 1 = 2$

9. **Ans - (c) - 64**

10. **Ans - (b) - 1923** Because $1923^{1923^{1923}} = (1924-1)^{1923^{1923}}$

By expanding it last term will be -1 so by dividing $1923^{1923^{1923}}$ by 1924 remainder will be 1923.

II. Answer the following questions.

1. The natural numbers divisible by 5 between 1 and 1000 = $(1000 \div 5) - 1 = 199$

2. $182 = 2^1 \times 7^1 \times 13^1$ so the number of divisors is $2 \times 2 \times 2 = 8$

$$3. \quad \frac{1}{4-1} + \frac{1}{16-1} + \frac{1}{36-1} + \frac{1}{400-1} = \frac{1}{3} + \frac{1}{15} + \frac{1}{35} + \frac{1}{399}$$

$$= \frac{665+133+57+5}{1995} = \frac{860}{1995} = \frac{172}{399}$$

4. The units digit of 7^{95} is = unit place of $(7^3)^{31} \times 7 \times 7 =$ unit place of $(1)^{31} \times 7 \times 7 = 9$

The units digit of $3^{58} = (3^4)^{14} \times 3 \times 3 = 9$

So the units digit of $7^{95} - 3^{58} = 0$

5. $1111 \div 99 = 11.22$ so 11 times 99 can be subtracted from 1111.

6. Do from right

$$\sqrt{10 + \sqrt{25 + \sqrt{108 + \sqrt{154 + \sqrt{225}}}}} = \sqrt{10 + \sqrt{25 + \sqrt{108 + \sqrt{154 + 15}}}} =$$

$$\sqrt{10 + \sqrt{25 + \sqrt{108 + \sqrt{169}}}} = \sqrt{10 + \sqrt{25 + \sqrt{108 + 13}}} = \sqrt{10 + \sqrt{25 + \sqrt{121}}}$$

$$= \sqrt{10 + \sqrt{25 + 11}} = \sqrt{10 + 6} = 4$$

$$7. \quad \sqrt{\frac{225}{729} - \frac{25}{144} + \frac{16}{81}} = \sqrt{\frac{16 \times 225 - 81 \times 25 + 144 \times 16}{11664}} = \sqrt{\frac{3600 - 2025 + 2304}{11664}} = \sqrt{\frac{3879}{11664}}$$

$$8. \quad \text{By Transposing } \frac{\sqrt{a}}{\sqrt{b}} = \frac{.016}{.4} \Rightarrow \frac{a}{b} = .0016$$

$$9. \quad \text{By squaring both sides } \frac{169+x}{169} = \frac{196}{169} \Rightarrow x = 196 - 169 = 27$$

$$10. \quad \sqrt{4a^2 - 4a + 1} + 3a = 2a - 1 + 3a = 5a - 1 = 5 \times 0.1039 - 1 = 0.5195 - 1 = -0.4805$$

Exercise - 2



I. Choose the correct answer.

Ans :

1. C. $(\frac{125}{8})$
2. D. $(\frac{1}{81})$
3. A. (-96)
4. C. $(\frac{729}{4096})$
5. D. none of these $(\frac{60}{7})$
6. A. $(\frac{289}{36})$
7. D. $(x = 3)$
8. D. $(x = 2)$
9. C. $(\frac{1}{16})$
10. A. $(\frac{19}{64})$

II. Match the following.

Ans : 1. C 2. A 3. B 4. E 5. D

III. Evaluate the following expressions.

Ans :

1. $\left(\frac{-2}{3}\right)^{-5} = \left(\frac{-3}{2}\right)^5 = \frac{-729}{32}$
2. $\left(\frac{1}{2}\right)^{-5} = 2^5 = 32$
3. $\left(\frac{4}{3}\right)^{-3} = \left(\frac{3}{4}\right)^3 = \frac{27}{64}$
4. $(-3)^{-4} = \left(\frac{-1}{3}\right)^4 = \frac{1}{81}$
5. $(4)^{-3} = \frac{1}{4^3} = \frac{1}{64}$

Application Skill Achiever



I. Answer the following questions as directed.

1. $\left(\frac{5}{3}\right)^{-4} \times \left(\frac{5}{3}\right)^{-5} = \left(\frac{5}{3}\right)^{3x}$
 $\Rightarrow -9 = 3x$
 $\therefore x = \frac{-9}{3} = -3$

$$2. \left(\frac{4}{9}\right)^4 \times \left(\frac{4}{9}\right)^{-7} = \left(\frac{4}{9}\right)^{2x-1}$$

$$\Rightarrow 2x - 1 = -3$$

$$\therefore 2x = -3 + 1 = -2$$

$$\therefore x = -1$$

$$3. (-6)^{-1} \times x = 9^{-1}$$

$$\Rightarrow x = \frac{(-6)^{-1}}{9^{-1}} = \frac{9}{-6} = -\frac{9}{6}$$

By $-\frac{9}{6}$ should $(-6)^{-1}$ be multiplied so that the product becomes 9^{-1}

$$4. \left(\frac{-2}{3}\right)^{-3} \div \left(\frac{4}{27}\right)^{-2} = \left(\frac{-3}{2}\right)^3 \div \left(\frac{27}{4}\right)^2 = \left(\frac{-3}{2}\right)^3 \times \left(\frac{4}{27}\right)^2 = \frac{-27}{8} \times \frac{16}{27 \times 27} = -\frac{2}{27}$$

$$5. 5^{2x+1} \div 25 = 125$$

$$5^{2x+1} \div 5^2 = 5^3$$

$$5^{2x+1-2} = 5^3$$

$$2x - 1 = 3$$

$$2x = 3 + 1 = 4$$

$$x = 2$$

II. Evaluate the following expressions.

$$1. \left(\frac{5}{3}\right)^2 \times \left(\frac{5}{3}\right)^2 = \frac{625}{81}$$

$$2. \left(\frac{5}{6}\right)^6 \times \left(\frac{5}{6}\right)^{-4} = \frac{25}{36}$$

$$3. \left(\frac{2}{3}\right)^{-3} \times \left(\frac{2}{3}\right)^{-2} = \left(\frac{2}{3}\right)^{-5} = \frac{243}{32}$$

$$4. \left(\frac{9}{8}\right)^{-3} \times \left(\frac{9}{8}\right)^2 = \left(\frac{9}{8}\right)^{-1} = \frac{8}{9}$$

$$5. \left(\frac{5}{9}\right)^{-2} \times \left(\frac{3}{5}\right)^{-3} \times \left(\frac{3}{5}\right)^0 = \frac{9 \times 9}{5 \times 5} \times \frac{5 \times 5 \times 5}{3 \times 3 \times 3} \times 1 = 15$$

$$6. \left(-\frac{3}{5}\right)^{-4} \times \left(-\frac{2}{5}\right)^2 = \left(\frac{5 \times 5 \times 5 \times 5}{3 \times 3 \times 3 \times 3}\right) \times \frac{2 \times 2}{5 \times 5} = \frac{100}{81}$$

$$7. \left(\frac{-2}{3}\right)^{-3} \times \left(\frac{-2}{3}\right)^{-2} = \left(\frac{-2}{3}\right)^{-5} = -\frac{243}{32}$$

$$8. \left\{\left(\frac{-2}{3}\right)^2\right\}^{-2} = \left(\frac{-2}{3}\right)^{-4} = \frac{81}{16}$$

$$9. \left[\left\{\left(\frac{-1}{3}\right)^2\right\}^{-2}\right]^{-1} = \left(\frac{-1}{3}\right)^4 = \frac{1}{81}$$

$$10. \left\{\left(\frac{3}{2}\right)^{-2}\right\}^2 = \left(\frac{3}{2}\right)^{-4} = \frac{16}{81}$$

$$11. \left\{\left(\frac{1}{3}\right)^{-3} - \left(\frac{1}{2}\right)^{-3}\right\} \div \left(\frac{1}{4}\right)^{-4} = (27 - 8) \div 256 = \frac{19}{256}$$

$$12. \left\{\left(\frac{4}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1} = \left(\frac{3}{4} - 4\right)^{-1} = -\frac{4}{13}$$

III) Simplify the following expressions.

$$1. [(2^3)^2]^5 = 2^{30}$$

$$2. (3^3)^5 \times (3^2)^{-5} \times 3^0 = 3^{15} \times 3^{-10} \times 3^0 = 3^{15-10} = 3^5 = 243$$

$$3. (2^8)^{-2} \times (16^2)^5 \times 4^{-4} = 2^{-16} \times 2^{4 \times 2 \times 5} \times 2^{2 \times (-4)} = 2^{16}$$

$$4. \left(\frac{2}{3}\right)^3 \times \left(1\frac{1}{2}\right)^5 = \left(\frac{2^3}{3^3}\right) \times \left(\frac{3^5}{2^5}\right) = \frac{3^2}{2^2} = \frac{9}{4} = 2\frac{1}{4}$$

$$5. \left(\frac{1}{4}\right)^3 \times \left(\frac{2}{3}\right)^4 \div \left(1\frac{1}{3}\right)^5 = \frac{1}{2^6} \times \frac{2^4}{3^4} \times \frac{3^5}{2^{10}} = \frac{3}{2^{12}} = \frac{3}{4096}$$

IV) Fill in the blanks.

Ans :

1) 8

2) 4

3) 3.445×10^{-3}

4) 1.265×10^7

5) 7×8^{-26}

6) 3

7) 2

8) 1

9) $2yz / (y + z)$

10) 4

Exercise - 3



I. Choose the correct answer.

- | | | | |
|--------------------|--------------------|-----------------|-----------------|
| 1. A - constant | 2. C - coefficient | 3. B - variable | 4. C - = |
| 5. B - 3 | 6. B - polynomial | 7. D (-4) | 8. C - monomial |
| 9. B - multinomial | 10. B - Trinomial | | |

II. Multiply the following monomials.

- $4xy \times \frac{3}{4}x^2y^2 = 12x^3y^3$
- $\frac{2}{3}x^2y \times x^3y^5 = \frac{2}{3}x^5y^6$
- $6x^2y^3 \times \frac{1}{2}xy^2 = 3x^3y^5$
- $\frac{1}{4}xy^5 \times 4x^4y^3 = x^5y^8$
- $3a^2b \times \frac{1}{6}a^4b^2 = \frac{1}{2}a^6b^3$

III. Simplify the following.

- $\frac{8x-4y}{4x^2-y^2} = \frac{4(2x-y)}{(2x+y)(2x-y)} = \frac{4}{2x+y}$
- $\frac{3p^2-15p^3q}{12p^2q} = \frac{3p^2(p-5pq)}{12p^2q} = \frac{p-5pq}{4q}$
- $\frac{6m-3}{2mn} + \frac{4m^2-1}{8m^2} = \frac{4m(6m-3)+n(4m^2-1)}{8m^2n} = \frac{24m^2-12m+4m^2n-n}{8m^2n} = \frac{4m^2n+24m^2-12m-n}{8m^2n}$
- $3a^2(2a^2-3)+4a(2a^3+3)-12(a+1) = 6a^4-9a^2+8a^4+12a-12a-12 = 14a^4-9a^2-12$

Application Skill Achiever



I. Multiply the following.

- $(2x + 3y + z)(4x) = 8x^2 + 12xy + 4zx$
- $(3x^2 + 4y)(x + 3y) = 3x^3 + 4xy + 9x^2y + 12y^2$
- $(5x^3 - 2y)(3x + 2y^2) = 15x^4 - 6xy + 10x^3y^2 - 4y^3$
- $(2xy^2 + 2y)(5y + 1) = 10xy^3 + 10y^2 + 2xy^2 + 2y$
- $(X + 2y^2 + 3z)(2x^2 + 2y + z) = 2x^3 + 4x^2y^2 + 6x^2z + 2xy + 4y^3 + 6yz + zx + 2y^2z + 3z^3$
- $(6xy + 4xz)(2xy - 2xz + x) = 12x^2y^2 + 8x^2yz - 12x^2yz - 8x^2z^2 + 6x^2y + 4x^2z$
 $= 12x^2y^2 - 4x^2yz - 8x^2z^2 + 6x^2y + 4x^2z$
- $(\frac{1}{2}x + \frac{1}{3}y)(\frac{1}{4}y + \frac{1}{3}) = \frac{1}{8}xy + \frac{1}{12}y^2 + \frac{1}{6}x + \frac{1}{9}y$

II. Divide the following.

1. $(2x^2 + 5x + 6) / (x + 3) =$

$$\begin{array}{r}
 2x - 1 \\
 x + 3 \overline{) 2x^2 + 5x + 6} \\
 \underline{2x^2 + 6x} \\
 -x + 6 \\
 \underline{-x - 3} \\
 9
 \end{array}$$

2. $(9x^2 + 6x + 1) / (3x + 1) =$

$$\begin{array}{r}
 3x + 1 \\
 3x + 1 \overline{) 9x^2 + 6x + 1} \\
 \underline{9x^2 + 3x} \\
 3x + 1 \\
 \underline{3x + 1} \\
 0
 \end{array}$$

3. $(9x^2 + 12x + 3) / (3x + 3)$

$$\begin{array}{r}
 3x + 1 \\
 3x + 3 \overline{) 9x^2 + 12x + 3} \\
 \underline{9x^2 + 9x} \\
 3x + 3 \\
 \underline{3x + 3} \\
 0
 \end{array}$$

4. $(27x^3 + 8y^3 + z^3 - 18xyz) / (3x + 2y + z)$
 $= \{(3x)^3 + (2y)^3 + z^3 - 3 \cdot 3x \cdot 2y \cdot z\} / (3x + 2y + z)$
 $= (3x)^2 + (2y)^2 + z^2 - 3x \cdot 2y - 2y \cdot z - 3x \cdot z$
 $= 9x^2 + 4y^2 + z^2 - 6xy - 2yz - 3zx$

5. $(16x^4 - 81y^4) / (2x - 3y)$
 $= \{(2x)^4 - (3y)^4\} / (2x - 3y)$
 $= \{(2x)^2 + (3y)^2\} \{(2x)^2 - (3y)^2\} / (2x - 3y)$
 $= \{(2x)^2 + (3y)^2\} (2x + 3y) (2x - 3y) / (2x - 3y)$
 $= (4x^2 + 9y^2)(2x + 3y)$

III. Find the remainder and the quotient in

1)

$$\begin{array}{r}
 5x^2 + 21x + 67 \\
 x - 3 \overline{) 5x^3 + 6x^2 + 4x - 7} \\
 \underline{5x^3 - 15x^2} \\
 21x^2 + 4x - 7 \\
 \underline{21x^2 - 63x} \\
 67x - 7 \\
 \underline{67x - 201} \\
 196
 \end{array}$$

Quotient : $5x^2 + 21x + 67$
Remainder : 196

2)

$$\begin{array}{r}
 x^3 + x \\
 x + 1 \overline{) x^4 + x^3 + x^2 + x} \\
 \underline{x^4 + x^3} \\
 x^2 + x \\
 \underline{x^2 + x} \\
 0
 \end{array}$$

Quotient : $x^3 + x$
Remainder : 0

IV. Answer the following questions.

- What must be added to $6x^4 - x^3 + 3x^2 + 4x - 2$ so that the result is exactly divisible by $(3x^2 - 2x + 4)$?
Also Obtain the expression that is exactly divisible.

$$\begin{array}{r}
 2x^2 + x \\
 3x^2 - 2x + 4 \overline{) 6x^4 - x^3 + 3x^2 + 4x - 2} \\
 \underline{6x^4 - 4x^3 + 8x^2} \\
 3x^3 - 5x^2 + 4x \\
 \underline{3x^3 - 2x^2 + 4x} \\
 -3x^2
 \end{array}$$

$3x^2$ must be added to $6x^4 - x^3 + 3x^2 + 4x - 2$ so that the result is exactly divisible by $(3x^2 - 2x + 4)$.

The expression will be $6x^4 - x^3 + 4x - 2$

- Show by division method that $(3x^2 + 5xy + 4y^2)$ is a factor of $9x^4 + 3x^3y + 16x^2y^2 + 24xy^3 + 32y^4$

$$\begin{array}{r}
 3x^2 - 4xy + 8y^2 \\
 3x^2 + 5xy + 4y^2 \overline{) 9x^4 + 3x^3y + 16x^2y^2 + 24xy^3 + 32y^4} \\
 \underline{9x^4 + 15x^3y + 12x^2y^2} \\
 -12x^3y + 4x^2y^2 + 24xy^3 + 32y^4 \\
 \underline{+12x^3y + 20x^2y^2 + 16xy^3} \\
 24x^2y^2 + 40xy^3 + 32y^4 \\
 \underline{24x^2y^2 + 40xy^3 + 32y^4} \\
 0
 \end{array}$$

The remainder is 0 so $(3x^2 + 5xy + 4y^2)$ is a factor of $9x^4 + 3x^3y + 16x^2y^2 + 24xy^3 + 32y^4$

3. Find the value of k so that $(x - 3)$ is a factor of $3x^2 + 11x + k$

According to the remainder theorem if $f(x) = 3x^2 + 11x + k$ is divisible by $x - 3$ then

$$F(3) = 3(3)^2 + 11 \times 3 + k = 0$$

$$27 + 33 + k = 0$$

$$K = -60$$

4. Find the product of $(x - 2)(x + 2)(x^2 + 4)(x^4 + 16)$

$$(x - 2)(x + 2)(x^2 + 4)(x^4 + 16) = (x^2 - 4)(x^2 + 4)(x^4 + 16) = (x^4 - 16)(x^4 + 16) = x^8 - 256$$

5. If the sides of a rectangle are $(x^2 - x + 2)$ and $(x^2 + x - 2)$, find the area and the perimeter of the

Rectangle. The area of the rectangle is $= (x^2 - x + 2) \times (x^2 + x - 2) = (x^2)^2 - (x - 2)^2$

$$= x^4 - (x^2 - 2x + 4) = x^4 - x^2 + 4x - 4$$

The perimeter of the rectangle $= 2\{(x^2 - x + 2) + (x^2 + x - 2)\} = 4x^2$

Exercise - 4



I. Fill in the blanks.

- | | | | |
|-------------------|-----------------|-----------------|---------------|
| 1) cosec θ | 2) tan θ | 3) sin θ | 4) length |
| 5) 1 | 6) 2 | 7) $\sqrt{2}$ | 8) hypotenuse |

II. Match the following.

- | | | | | |
|------|------|------|------|------|
| 1) D | 2) E | 3) B | 4) C | 5) A |
|------|------|------|------|------|

Application Skill Achiever



I. Answer the following questions.

1. In the right angled triangle the hypotenuse = 8 cm

The base = 7 cm.

$$\text{The perpendicular} = \sqrt{8^2 - 7^2} = \sqrt{15}$$

$$\sin(90 - \theta) = \cos \theta = \frac{7}{8}$$

$$\cos(90 - \theta) = \sin \theta = \frac{\sqrt{15}}{8}$$

$$\tan(90 - \theta) = \cot \theta = \frac{7}{\sqrt{15}} \text{ m/m}$$

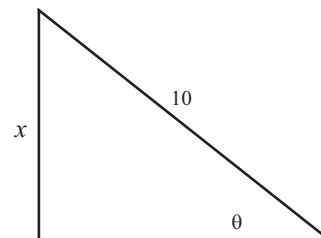
2. In the right angled triangle $\sin \theta \cdot \cos \theta + \tan \theta = \frac{\sqrt{15}}{8} \times \frac{7}{8} + \frac{\sqrt{15}}{7} = \frac{49\sqrt{15} + 64\sqrt{15}}{448} = \frac{113\sqrt{15}}{448}$

3) $\sin 60 = \frac{x}{10}$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{x}{10}$$

$$\therefore x = \frac{10\sqrt{3}}{2} = 5\sqrt{3}$$

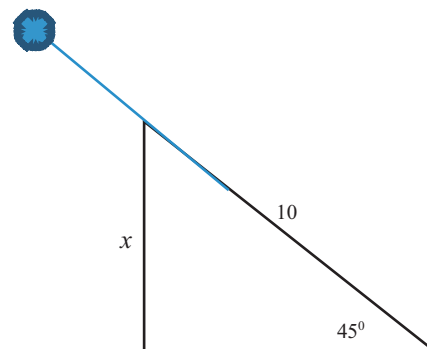
The height of the wall is $5\sqrt{3}$



4) $\cos 60 = \frac{x}{10}$

$$\Rightarrow \frac{1}{2} = \frac{x}{10}$$

$$X = 5\text{m}$$



$$5) \quad \tan 45 = \frac{x}{20}$$

$$\Rightarrow 1 = \frac{x}{20}$$

$$X = 20\text{m}$$

The height of the building is 20m.

$$6) \quad \tan 30 = \frac{x}{120}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{120}$$

$$\therefore x = \frac{120}{\sqrt{3}} = 40\sqrt{3}\text{m}$$

$$7) \quad \tan 45 = \frac{x}{60}$$

$$\Rightarrow 1 = \frac{x}{60}$$

$$x = 60 \text{ m.}$$

The height of the fort is $60\text{m} + 1.8\text{m} = 61.8 \text{ m.}$

$$8) \quad \tan 30 = \frac{x}{90}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{90}$$

$$\therefore x = \frac{90}{\sqrt{3}} = 30\sqrt{3}\text{m}$$

The height of the tree is $30\sqrt{3} \text{ m.}$

9) let the height of the hill AB is = x m.

$$\tan 30 = \frac{AE}{BC}$$

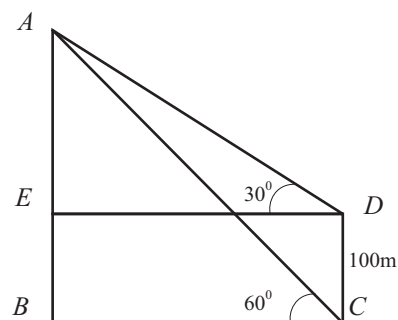
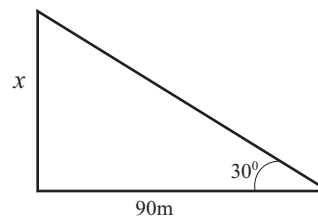
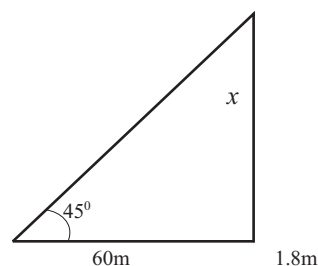
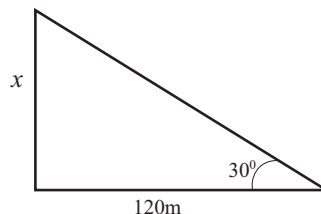
$$\frac{1}{\sqrt{3}} = \frac{x-100}{BC}$$

$$BC = (x-100)\sqrt{3}$$

$$\tan 60 = \frac{AB}{BC} = \frac{x}{BC}$$

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

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



$$\frac{x}{\sqrt{3}} = (x - 100)\sqrt{3}$$

$$x = 3x - 300$$

$$x - 3x = -300$$

$$x = 150m.$$

The height of the hill AB is = 150 m.

10) the height of the hill = AB = 450m.

Let the height of the fort = CD = x

$$\tan 30^\circ = \frac{450 - x}{AD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{450 - x}{AD}$$

$$AD = (450 - x)\sqrt{3}$$

$$\tan 60^\circ = \frac{450}{AD}$$

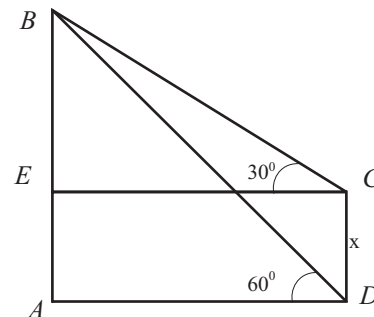
$$\Rightarrow \sqrt{3} = \frac{450}{AD}$$

$$AD = \frac{450}{\sqrt{3}}$$

$$(450 - x)\sqrt{3} = \frac{450}{\sqrt{3}}$$

$$\Rightarrow 450 - x = \frac{450}{\sqrt{3} \times \sqrt{3}}$$

$$\therefore x = 450 - 150 = 300m.$$



The height of the fort is 300m.

II. Do the following as directed.

1. Prove that $\cot^2 \theta - \frac{1}{\sin^2 \theta} + 1 = 0$

$$\text{LHS} = \cot^2 \theta - \frac{1}{\sin^2 \theta} + 1 = \frac{\cos^2 \theta}{\sin^2 \theta} - \frac{1}{\sin^2 \theta} + 1 = \frac{\cos^2 \theta - 1 + \sin^2 \theta}{\sin^2 \theta} = \frac{0}{\sin^2 \theta} = 0 = \text{RHS}$$

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

$$\begin{aligned} LHS &= \frac{1}{\cos\theta + \sin\theta} - \frac{1}{\cos\theta - \sin\theta} = \frac{\cos\theta - \sin\theta - (\cos\theta + \sin\theta)}{\cos^2\theta - \sin^2\theta} \\ &= \frac{\cos\theta - \sin\theta - \cos\theta - \sin\theta}{1 - \sin^2\theta - \sin^2\theta} = \frac{-2\sin\theta}{1 - 2\sin^2\theta} = \frac{2\sin\theta}{2\sin^2\theta - 1} = RHS \end{aligned}$$

3) prove that $\sin^2\theta(1 + \cot^2\theta) = 1$

$$LHS = \sin^2\theta \left(1 + \frac{\cos^2\theta}{\sin^2\theta} \right) = \sin^2\theta \left(\frac{\sin^2\theta + \cos^2\theta}{\sin^2\theta} \right) = \sin^2\theta \times \frac{1}{\sin^2\theta} = 1 = RHS$$

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

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

5) Show that $(1 + \cos\theta)(1 - \cos\theta) \cot^2\theta = (1 - \sin\theta)(1 + \sin\theta)$

$$\begin{aligned} LHS &= (1 + \cos\theta)(1 - \cos\theta) \cot^2\theta = (1 - \cos^2\theta) \cdot \cot^2\theta = \sin^2\theta \times \frac{\cos^2\theta}{\sin^2\theta} \\ &= \cos^2\theta = 1 - \sin^2\theta = (1 + \sin\theta)(1 - \sin\theta) = RHS \end{aligned}$$

6) Show that $\sec^2\theta + \operatorname{cosec}^2\theta = (\tan\theta + \cot\theta)^2$

$$\begin{aligned} LHS &= \sec^2\theta + \operatorname{cosec}^2\theta = 1 + \tan^2\theta + 1 + \cot^2\theta = \tan^2\theta + \cot^2\theta + 2 \\ &= \tan^2\theta + \cot^2\theta + 2 \cdot \tan\theta \cdot \cot\theta = (\tan\theta + \cot\theta)^2 = RHS \end{aligned}$$

7) $(1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta) - 2 = 0$

$$\begin{aligned} LHS &= (1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta) - 2 \\ &= \left(1 + \frac{\sin\theta}{\cos\theta} + \frac{1}{\cos\theta} \right) \left(1 + \frac{\cos\theta}{\sin\theta} - \frac{1}{\sin\theta} \right) - 2 \\ &= \left(\frac{\cos\theta + \sin\theta + 1}{\cos\theta} \right) \left(\frac{\sin\theta + \cos\theta - 1}{\sin\theta} \right) - 2 \\ &= \left(\frac{\cos^2\theta + \sin^2\theta + 2 \cdot \sin\theta \cdot \cos\theta - 1}{\cos\theta \cdot \sin\theta} \right) - 2 = \left(\frac{1 + 2 \sin\theta \cdot \cos\theta - 1}{\cos\theta \cdot \sin\theta} \right) - 2 = \left(\frac{2 \sin\theta \cdot \cos\theta}{\cos\theta \cdot \sin\theta} \right) - 2 \\ &= 2 - 2 = 0 = RHS \end{aligned}$$

8) $\sec^2\theta \cdot \operatorname{cosec}^2\theta - 2 = \tan^2\theta + \cot^2\theta$

$$\begin{aligned} LHS &= \sec^2\theta \cdot \operatorname{cosec}^2\theta - 2 = \frac{1}{\cos^2\theta} \times \frac{1}{\sin^2\theta} - 2 = \frac{1}{\sin^2\theta \cdot \cos^2\theta} - 2 = \frac{\sin^2\theta + \cos^2\theta}{\sin^2\theta \cdot \cos^2\theta} - 2 \\ &= \frac{\sin^2\theta}{\sin^2\theta \cdot \cos^2\theta} + \frac{\cos^2\theta}{\sin^2\theta \cdot \cos^2\theta} - 2 = \frac{1}{\cos^2\theta} + \frac{1}{\sin^2\theta} - 2 = \sec^2\theta + \operatorname{cosec}^2\theta - 2 \\ &= \tan^2\theta + 1 + \cot^2\theta + 1 - 2 = \tan^2\theta + \cot^2\theta = RHS \end{aligned}$$

$$9) \quad \text{LHS} = \cos^4 A - \sin^4 A = (\cos^2 A + \sin^2 A)(\cos^2 A - \sin^2 A) = \cos^2 A - \sin^2 A = \text{RHS}$$

$$10) \quad \text{LHS} = \sec^2 \theta \cdot \text{cosec}^2 \theta - 2 = \frac{1}{\cos^2 \theta} \times \frac{1}{\sin^2 \theta} - 2 = \frac{1}{\sin^2 \theta \cdot \cos^2 \theta} - 2 = \frac{\sin^2 \theta + \cos^2 \theta}{\sin^2 \theta \cdot \cos^2 \theta} - 2$$

$$= \frac{\sin^2 \theta}{\sin^2 \theta \cdot \cos^2 \theta} + \frac{\cos^2 \theta}{\sin^2 \theta \cdot \cos^2 \theta} - 2 = \frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta} - 2 = \sec^2 \theta + \text{cosec}^2 \theta - 2$$

$$= \tan^2 \theta + 1 + \cot^2 \theta + 1 - 2 = \tan^2 \theta + \cot^2 \theta = \frac{1}{\cot^2 \theta} + \cot^2 \theta = \frac{1 + \cot^4 \theta}{\cot^2 \theta} = \text{RHS}$$

I) Answer the following questions.

11) Let the pole is AC and CD is painted white and the point 4m. far from C is B.

$$\tan \theta = \frac{3}{4}$$

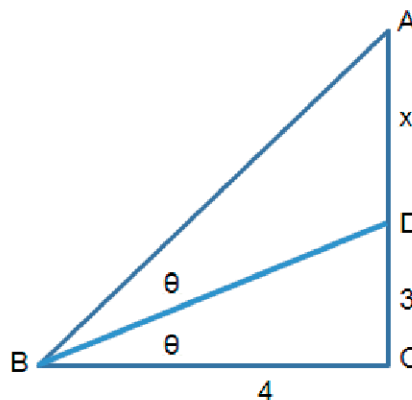
Let $AD = x \text{ meter}$

$$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta} = \frac{2 \times \frac{3}{4}}{1 - \frac{9}{16}} = \frac{6}{4} \times \frac{16}{7} = \frac{96}{28}$$

$$\therefore \frac{x+3}{4} = \frac{96}{28}$$

$$\Rightarrow x = \frac{96}{28} \times 4 - 3 = 20\frac{5}{7} \text{ m.}$$

The length of the pole pointed black is $20\frac{5}{7} \text{ m.}$



Exercise - 5



I. Convert the following statements into equations using a variable.

- a) $x + 5 = 9$ B) $x - 3 = 12$ c) $5x - 2 = 4$ d) $2(x + 7) = 13$ e) $5 - \frac{x}{3} = 3$

II. Solve each of the following equations.

a) $7x + 2 = -19$

$$\Rightarrow 7x = -19 - 2 = -21$$

$$\Rightarrow x = \frac{-21}{7} = -3$$

b) $3x - \frac{1}{3} = 5$

$$\Rightarrow \frac{9x - 1}{3} = 5$$

$$\Rightarrow 9x - 1 = 5 \times 3 = 15$$

$$\Rightarrow 9x = 15 + 1 = 16$$

$$\Rightarrow x = \frac{16}{9} = 1\frac{7}{9}$$

c) $5x - 4 = 21$

$$\Rightarrow 5x = 21 + 4$$

$$\Rightarrow x = 25 \div 5 = 5$$

d) $-7x = 21$

$$\Rightarrow x = 21 \div (-7) = -3$$

e) $18 - 7x = -3$

$$\Rightarrow -7x = -3 - 18$$

$$\Rightarrow x = (-21) \div (-7) = 3$$

f) $3(x + 4) = 21$

$$\Rightarrow x + 4 = 21 \div 3 = 7$$

$$\Rightarrow x = 7 - 4 = 3$$

$$\text{g)} \quad \frac{2x}{3} - \frac{3x}{5} = 8$$

$$\Rightarrow \frac{10x - 9x}{15} = 8$$

$$\Rightarrow x = 8 \times 15$$

$$\Rightarrow x = 120$$

$$\text{h)} \quad 3x - 9 = 5x - 3$$

$$\Rightarrow 3x - 5x = -3 + 9$$

$$\Rightarrow -2x = 6$$

$$\Rightarrow x = 6 \div (-2) = -3$$

$$\text{i)} \quad 3(x - 3) = 4(2x + 1)$$

$$\Rightarrow 3x - 9 = 8x + 4$$

$$\Rightarrow 3x - 8x = 4 + 9$$

$$\Rightarrow -5x = 13$$

$$\Rightarrow x = \frac{13}{-5} = -2\frac{3}{5}$$

Application Skill Achiever



I. Solve each of the equations and check your solution by substituting in the Equation.

$$\text{A)} \quad \frac{3x}{2} - 10 = \frac{1}{2}$$

$$\Rightarrow \frac{3x - 20}{2} = \frac{1}{2}$$

$$\Rightarrow 3x - 20 = 1$$

$$\Rightarrow 3x = 1 + 20 = 21$$

$$\Rightarrow x = 21 \div 3 = 7$$

$$\text{B)} \quad \frac{x}{2} - \frac{x}{3} = 8 \quad \Rightarrow \frac{3x - 2x}{6} = 8 \quad \Rightarrow \frac{x}{6} = 8$$

$$\Rightarrow x = 8 \times 6 = 48$$

$$\text{c) } 2(x - 2) - 5(x - 5) = 4(x - 8) - 2(x - 2)$$

$$\Rightarrow 2x - 4 - 5x + 25 = 4x - 32 - 2x + 4$$

$$\Rightarrow -3x - 2x = -28 - 21$$

$$\Rightarrow -5x = -49$$

$$\Rightarrow x = \frac{49}{5} = 9\frac{4}{5}$$

$$\text{d) } 6x - 9 - 2(1 - x) = x + 9$$

$$\Rightarrow 6x - 9 - 2 + 2x = x + 9$$

$$\Rightarrow 6x + 2x - x = 9 + 9 + 2$$

$$\Rightarrow 7x = 20$$

$$\Rightarrow x = \frac{20}{7} = 2\frac{6}{7}$$

$$\text{e) } \frac{2-y}{y+7} = \frac{3}{5}$$

$$\Rightarrow 10 - 5y = 3y + 21$$

$$\Rightarrow -5y - 3y = 21 - 10$$

$$\Rightarrow -8y = 11$$

$$\Rightarrow y = \frac{11}{-8} = -1\frac{3}{8}$$

$$\text{F) } \frac{3x+2}{2x-3} = -\frac{3}{2}$$

$$\Rightarrow 6x + 4 = -6x + 9$$

$$\Rightarrow 6x + 6x = 9 - 4$$

$$\Rightarrow 12x = 5$$

$$\Rightarrow x = \frac{5}{12}$$

$$\text{G) } \frac{x-8}{3} = \frac{x-3}{5}$$

$$\Rightarrow 5x - 40 = 3x - 9$$

$$\Rightarrow 5x - 3x = -9 + 40$$

$$\Rightarrow 2x = 31$$

$$\Rightarrow x = \frac{31}{2} = 15\frac{1}{2}$$

$$\text{h) } 0.25(4y - 3) = 0.5y - 9$$

$$\Rightarrow y - .75 = 0.5y - 9$$

$$\Rightarrow y - .5y = -9 + .75$$

$$\Rightarrow .5y = -8.25$$

$$\Rightarrow y = \frac{-8.25}{.5} = -16.5$$

II. Answer the following questions.

$$1) \text{ Let a number is } = x$$

$$\text{The other number is } = x + 12$$

$$\text{Their sum } = x + x + 12 = 2x + 12$$

$$\Rightarrow 2x + 12 = 48$$

$$\Rightarrow 2x = 48 - 12$$

$$\Rightarrow x = 36 \div 2 = 18$$

The numbers are 18 and 30.

$$2) \ 2x - 22 = 48$$

$$\Rightarrow 2x = 48 + 22 = 70$$

$$x = 70 \div 2 = 35$$

The number is 35

$$3) \ 7x = 10x - 36$$

$$\Rightarrow 7x - 10x = -36$$

$$\Rightarrow -3x = -36$$

$$\therefore x = \frac{-36}{-3} = 12$$

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

$$\Rightarrow \frac{4}{5}x - \frac{3}{4}x = 5$$

$$\Rightarrow x \left(\frac{16 - 15}{20} \right) = 5$$

$$\Rightarrow x = 5 \times \frac{20}{1} = 100$$

The number is 100.

5) Let the consecutive even numbers are x and $x + 2$

$$x + x + 2 = 38$$

$$\Rightarrow 2x + 2 = 38$$

$$\Rightarrow 2x = 38 - 2 = 36$$

$$\Rightarrow x = 36 \div 2 = 18$$

The numbers are 18 and 20

6) Let the three consecutive 3 odd numbers are $x-2$, x , $x+2$

$$\text{Their sum} = x - 2 + x + x + 2 = 3x$$

$$3x = 51$$

$$X = 51 \div 3 = 17$$

The numbers are 15, 17 and 19.

7) Let the age of Rene = x

$$\text{Her younger sister age is} = x - 6$$

$$\text{After 10 years sum of their age} = x + x - 6 + 2 \times 10 = 2x + 14$$

$$2x + 14 = 50$$

$$2x = 50 - 14 = 36$$

$$X = 36 \div 2 = 18$$

Rene's present age is 18 and her sister's age is 12

8) Let the breadth of a rectangle = x

$$\text{Length} = x + 10\text{m.}$$

$$\text{perimeter of the rectangle} = 2(l + b) = 2(x + x + 10) = 2(2x + 10) = 4x + 20$$

$$4x + 20 = 80\text{m}$$

$$4x = 80 - 20 = 60\text{m.}$$

$$\Rightarrow x = 60\text{m.} \div 4 = 15\text{m.}$$

The breadth of the rectangle is 15m. and the length is 25m.

9) Let the breadth of the plot = x

$$\text{Length} = 2x$$

$$\text{perimeter of the rectangle} = 2(l + b) = 2(x + 2x) = 2(3x) = 6x$$

$$\Rightarrow 6x = 300\text{m} \quad \Rightarrow x = 300 \div 6 = 50\text{m.}$$

The breadth of the plot is 50m. and the length is 100m.

10) let the numerator of the fraction = x

The denominator = x + 8

The fraction = $\frac{x}{x+8}$

$$\frac{x+17}{x+8+1} = \frac{3}{2}$$

$$2x + 34 = 3x + 27$$

$$2x - 3x = 27 - 34$$

$$x = 7$$

The fraction is $\frac{7}{15}$

11) Let the number of 100 rupee prizes is = x

The number of 25 rupee prizes = 63 - x

The total cost of the prizes = 100(x) + 25(63 - x) = 100x + 1575 - 25x = 75x + 1575

$$\Rightarrow 75x + 1575 = 2700$$

$$\Rightarrow 75x = 2700 - 1575 = 1125$$

$$X = 1125 \div 75 = 15$$

The number of 100 rupee prizes is 15 and 25 rupee prizes is 48.

12) Let the number of girls in the class = x

The number of boys in the class = $\frac{2}{5}x$

The sum of the boys and girls = $\frac{2}{5}x + x = \frac{2x + 5x}{5} = \frac{7x}{5}$

$$\frac{7x}{5} = 42 \Rightarrow x = 42 \times \frac{5}{7} = 30$$

The number of girls in the class is 30 and the number of boys is 12.

13) let my present age = x

My mother's present age = x + 12

$$x + 12 + 8 = 3x - 20$$

$$\Rightarrow X - 3x = -20 - 20 = -40$$

$$\Rightarrow X = \frac{-40}{-2} = 20$$

My present age is 20 and my mother's present age is 32

14) $80 + 2x = 180$

$$\Rightarrow 2x = 180 - 80 = 100$$

$$\Rightarrow x = 100 \div 2 = 50$$

The base angles of the triangle are 50°.

15) Let Adman's age = x

$$4x + 5 = 49$$

$$\Rightarrow 4x = 49 - 5 = 44$$

$$\Rightarrow x = 44 \div 4 = 11$$

Adman's age is 11.

16) Let the cost of an eraser = x

$$\text{The cost of a pencil} = x + 25$$

$$\text{Cost of 8 pencils and 10 erasers} = 8(x + 25) + 10x = 8x + 200 + 10x = 18x + 200$$

$$18x + 200 = 1280$$

$$\Rightarrow 18x = 1280 - 200 = 1080$$

$$\Rightarrow x = 1080 \div 18 = 60 \text{ ps.}$$

The cost of an eraser is 60 paise and cost of a pencil is 85 paise.

17) Let the first part = x

$$\text{The other part} = 36 - x$$

$$\therefore \frac{1}{5}x = \frac{36 - x}{7}$$

$$\Rightarrow 7x = 180 - 5x$$

$$\Rightarrow 7x + 5x = 180$$

$$\therefore x = \frac{180}{12} = 15$$

One part = 15

The other part = 21

18) let the present breadth of the rectangle = x

$$\text{Length} = x + 3$$

After increasing 2cm the breadth = x + 2

$$\text{Length} = x + 3 + 2 = x + 5$$

$$\text{Area} = (x + 2)(x + 5) = x^2 + 7x + 10$$

$$x^2 + 7x + 10 = 70$$

$$\Rightarrow x^2 + 7x + 10 - 70 = 0$$

$$\Rightarrow x^2 + 7x - 60 = 0$$

$$\Rightarrow x^2 + 12x - 5x - 60 = 0$$

$$\Rightarrow (x + 12)(x - 5) = 0$$

So either x = -12 or 5

The breadth cannot be a negative number so the breadth is 5 cm. And the length is 8cm.

19) Let the width of the rectangle = x

$$\text{Length} = 3x$$

$$\text{Perimeter} = 2(x + 3x) = 8x$$

$$8x = 96\text{m.}$$

$$x = 96\text{m.} \div 8 = 12\text{m}$$

$$\text{Width} = 12\text{m.}$$

$$\text{Length} = 12\text{m.} \times 3 = 36\text{m.}$$

20) Let Rahim's age = x

$$\text{His father's age} = 3x$$

$$\text{Sum of their age} = 4x$$

$$4x = 56\text{years}$$

$$x = 56 \div 4 = 14\text{years}$$

$$\text{Rahim's age} = 14\text{years}$$

$$\text{His father's age} = 56 - 14 = 42\text{years}$$

Exercise - 6



I. Which of the following are quadratic equations?

A, b, d, e, f and g are quadratic equations.

II. Match the following.

- 1) e 2) a 3) d 4) b 5) c

Application Skill Achiever



I. Solve the following equations using factorization process.

1) $x^2 + 3x + 2 = 0$

$$\Rightarrow (x + 2)(x + 1) = 0$$

$$X = -2 \text{ or } -1$$

2) $x^2 + 5x + 6 = 0$

$$\Rightarrow (x + 3)(x + 2) = 0$$

$$\text{So } x = -3 \text{ or } -2$$

3) $x^2 + 5x + 4 = 0$

$$\Rightarrow (x + 4)(x + 1) = 0$$

$$x = -4 \text{ or } -1$$

4) $x^2 + 6x + 5 = 0$

$$\Rightarrow (x + 1)(x + 5) = 0$$

$$\text{So } x = -1 \text{ or } -5$$

5) $x^2 + 7x + 10 = 0$

$$\Rightarrow (x + 5)(x + 2) = 0$$

$$\text{So } x = -5 \text{ or } -2$$

6) $x^2 - 3x - 10 = 0$

$$\Rightarrow (x - 5)(x + 2) = 0$$

$$\text{So } x = 5 \text{ or } -2$$

7) $4x^2 - 1 = 0$

$$\Rightarrow (2x + 1)(2x - 1) = 0$$

$$x = -\frac{1}{2} \text{ or } \frac{1}{2}$$

$$8) \quad 4x^2 - 2x - 2 = 0$$

$$\Rightarrow (x - 1)(4x + 2) = 0$$

$$\Rightarrow 2(x - 1)(2x + 1) = 0$$

$$\text{So } x = 1 \text{ or } \frac{1}{2}$$

$$9) \quad x^2 - 5x - 6 = 0$$

$$\Rightarrow (x - 6)(x + 1) = 0$$

$$\text{So } x = 6 \text{ or } -1$$

$$10) \quad x^2 - 9x + 18 = 0$$

$$\Rightarrow (x - 6)(x - 3) = 0$$

$$\text{So } x = 6 \text{ or } x = 3$$

$$11) \quad x^2 + 8x + 15 = 0$$

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

$$\text{So } x = -5 \text{ or } -3$$

$$12) \quad x^2 + 9x + 20 = 0$$

$$\Rightarrow (x + 5)(x + 4) = 0$$

$$\text{So } x = -5 \text{ or } -4$$

$$13) \quad 4x^2 - 4x - 15 = 0$$

$$\Rightarrow (2x - 5)(2x + 3) = 0$$

$$\text{So } x = \frac{5}{2} \text{ or } \frac{-3}{2}$$

$$14) \quad 4x^2 - 2x - 20 = 0$$

$$\Rightarrow (2x - 5)(2x + 4) = 0$$

$$\text{So } x = \frac{5}{2} \text{ or } -2$$

$$15) \quad 2x^2 - 15x + 25 = 0$$

$$\Rightarrow (x - 5)(2x - 5) = 0$$

$$\text{So } x = 5 \text{ or } \frac{5}{2}$$

$$16) \quad 9x^2 + 9x + 2 = 0$$

$$\Rightarrow (3x + 2)(3x + 1) = 0$$

$$\text{So } x = \frac{-2}{3} \text{ or } \frac{-1}{3}$$

$$17) 6x^2 - x - 1 = 0$$

$$\Rightarrow (2x - 1)(3x + 1) = 0$$

$$\text{So } x = \frac{1}{2} \text{ or } -\frac{1}{3}$$

$$18) x^2 - 3x - 18 = 0$$

$$\Rightarrow (x - 6)(x + 3) = 0$$

$$\text{So } x = 6 \text{ or } -3$$

$$19) 5x^2 - 8x + 3 = 0$$

$$\Rightarrow (x - 1)(5x - 3) = 0$$

$$\text{So } x = 1 \text{ or } \frac{3}{5}$$

$$20) 6x^2 - 7x - 5 = 0$$

$$\Rightarrow (3x - 5)(2x + 1) = 0$$

$$\text{So } x = \frac{5}{3} \text{ or } -\frac{1}{2}$$

II. With the help of quadratic formula, solve each of the following equations.

$$1) x^2 - 6x = 27$$

$$\Rightarrow x^2 - 6x - 27 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-6) \pm \sqrt{36 - 4 \times 1 \times (-27)}}{2} = \frac{6 \pm \sqrt{36 + 108}}{2} = \frac{6 \pm 12}{2}$$

$$x = 9 \text{ or } x = -3$$

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

$$\Rightarrow 16x^2 - 24x + 9 - 2x - 6 = 0$$

$$\Rightarrow 16x^2 - 26x + 3 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-26) \pm \sqrt{(-26)^2 - 4 \times 16 \times (3)}}{2 \times 16} = \frac{26 \pm \sqrt{676 - 192}}{32} = \frac{26 \pm 22}{32}$$

$$x = \frac{48}{32} \text{ or } x = \frac{4}{32} = \frac{1}{8}$$

$$3) x^2 - 10x + 21 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-10) \pm \sqrt{(-10)^2 - 4 \times 1 \times (21)}}{2} = \frac{10 \pm \sqrt{100 - 84}}{2} = \frac{10 \pm 4}{2}$$

$$x = 7 \text{ or } 3$$

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 2 \times (-2)}}{2 \times 2} = \frac{3 \pm \sqrt{9+16}}{4} = \frac{3 \pm 5}{4}$$

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

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

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(6) \pm \sqrt{(6)^2 - 4 \times 1 \times (-10)}}{2} = \frac{-6 \pm \sqrt{36+40}}{2} = \frac{-6 \pm \sqrt{76}}{2}$$

$$x = \frac{-6 + 2\sqrt{19}}{2} = -3 + \sqrt{19} \quad \text{or } x = -3 - \sqrt{19}$$

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

$$\Rightarrow 9x^2 + 24x + 16 - 3x - 6 = 0$$

$$\Rightarrow 9x^2 + 21x + 10 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(21) \pm \sqrt{(21)^2 - 4 \times 9 \times (10)}}{2 \times 9} = \frac{-21 \pm \sqrt{441-360}}{18} = \frac{-21 \pm \sqrt{81}}{18}$$

$$x = \frac{-12}{18} = -\frac{2}{3} \quad \text{or } x = \frac{-30}{18} = -1\frac{2}{3}$$

$$7) 6x^2 - 4x - 26 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-4) \pm \sqrt{(-4)^2 - 4 \times \sqrt{6} \times (-2\sqrt{6})}}{2 \times \sqrt{6}} = \frac{4 \pm \sqrt{16+48}}{2\sqrt{6}} = \frac{4 \pm \sqrt{64}}{2\sqrt{6}}$$

$$x = \frac{4 + \sqrt{64}}{2\sqrt{6}} = \frac{12}{2\sqrt{6}} = \sqrt{6} \quad \text{Or } x = \frac{4 - \sqrt{64}}{2\sqrt{6}} = \frac{4}{2\sqrt{6}} = \frac{2}{\sqrt{6}}$$

$$8) (4x - 2)^2 + 6x - 25 = 0$$

$$\Rightarrow 16x^2 - 16x + 4 + 6x - 25 = 0$$

$$\Rightarrow 16x^2 - 10x - 21 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-10) \pm \sqrt{(-10)^2 - 4 \times 16 \times (-21)}}{2 \times 16} = \frac{10 \pm \sqrt{100+1344}}{32} = \frac{10 \pm \sqrt{1444}}{32}$$

$$x = \frac{48}{32} = 1\frac{1}{2} \quad \text{or } x = -\frac{28}{32} = -\frac{7}{8}$$

$$\begin{aligned}
9) \quad \frac{4}{x} - 3 &= \frac{5}{2x+3} \\
\Rightarrow \frac{4-3x}{x} &= \frac{5}{2x+3} \\
\Rightarrow 8x - 6x^2 + 12 - 3x &= 5x \\
\Rightarrow -6x^2 + 12 &= 0 \\
x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(0) \pm \sqrt{(0)^2 - 4 \times (-6) \times (12)}}{2 \times (-6)} = \frac{\pm \sqrt{288}}{-12} = \frac{\pm \sqrt{288}}{-12} \\
X &= -\sqrt{2} \text{ or } \sqrt{2}
\end{aligned}$$

$$\begin{aligned}
10) \quad \frac{2x+3}{x+3} &= \frac{x+4}{x+2} \\
\Rightarrow 2x^2 + 4x + 3x + 6 &= x^2 + 3x + 4x + 12 \\
\Rightarrow X^2 - 6 &= 0 \\
X &= \pm \sqrt{6}
\end{aligned}$$

III. Solve the following problems using the factorizing method.

1) let the numbers are x and $x + 3$

$$\text{Sum of their squares} = x^2 + (x + 3)^2 = x^2 + x^2 + 9 + 6x = 2x^2 + 6x + 9$$

$$2x^2 + 6x + 9 = 117$$

$$\Rightarrow 2x^2 + 6x + 9 - 117 = 0$$

$$\Rightarrow 2x^2 + 6x - 108 = 0$$

$$\Rightarrow 2(x^2 + 3x - 54) = 0$$

$$\Rightarrow 2(x + 9)(x - 6)$$

$$X = -9 \text{ or } 6$$

The numbers are -9 and -6 Or The numbers are 6 and 9

2) Let the numbers are x and $x + 2$

$$X(x + 2) = 2499$$

$$\Rightarrow x^2 + 2x - 2499 = 0$$

$$\Rightarrow (x + 51)(x - 49) = 0$$

$$\text{So } x = -51 \text{ or } 49$$

The numbers are 49 and 51 (because the numbers are positive according to question)

- 3) Let the numbers are x and $x + 2$

$$X(x + 2) = 168$$

$$\Rightarrow x^2 + 2x - 168 = 0$$

$$\Rightarrow (x + 14)(x - 12) = 0$$

$$\text{So } x = -14 \text{ or } 12$$

The numbers are 12 and 14 (because the numbers are positive according to question)

- 4) Let the numbers are x and $x + 1$

$$X(x + 1) = 3906$$

$$\Rightarrow x^2 + x - 3906 = 0$$

$$\Rightarrow (x + 63)(x - 62) = 0$$

$$\text{So } x = -63 \text{ or } 62$$

The numbers are -63 and -62 Or the numbers are 62 and 63

- 5) $x(51 - x) = 608$

$$\Rightarrow -x^2 + 51x - 608 = 0$$

$$\Rightarrow x^2 - 51x + 608 = 0$$

$$\Rightarrow (x - 19)(x - 32) = 0$$

$$X = 19 \text{ or } 32$$

So the numbers are 19 and 32.

- 6) Let there are x members in the party The number of gifts = $x(x - 1)/2$

$$\frac{x(x - 1)}{2} = 66$$

$$\Rightarrow x^2 - x = 132$$

$$\Rightarrow x^2 - x - 132 = 0$$

$$\Rightarrow (x - 12)(x + 11) = 0$$

$$\text{So } x = 12$$

There are 12 members in the party.

- 7) let the digits of the number is x and $x + 1$

$$X^2 + (x + 1)^2 = 10x + (x + 1) - 4$$

$$\Rightarrow x^2 + x^2 + 2x + 1 = 10x + x + 1 - 4$$

$$\Rightarrow 2x^2 + 2x - 11x + 1 + 3 = 0$$

$$\Rightarrow 2x^2 - 9x + 4 = 0$$

$$\Rightarrow (x - 4)(2x - 1)$$

$$X = 4 \text{ or } x = \frac{1}{2} \text{ (not possible)}$$

The number is 45

- 8) let the number of rows = x

The number of students in each row = $x + 4$

The total no. of students = $x(x + 4)$

$$X(x + 4) = 780$$

$$\Rightarrow x^2 + 4x - 780 = 0$$

$$\Rightarrow (x + 30)(x - 26) = 0$$

So $x = -30$ or 26

The number of rows cannot be a negative number so it is 26

The number of students in each row 30

- 9) let the first pipe fills the cistern in x minutes And the second pipe fills the cistern in $x + 5$ minutes

So in 1 minute both the pipes will fill = $\frac{1}{x} + \frac{1}{x+5}$

So by both the pipes the cistern will fill = $1 \div \left(\frac{1}{x} + \frac{1}{x+5} \right) = 1 \div \frac{x+5+x}{x(x+5)} = \frac{x(x+5)}{2x+5}$

$$\frac{x(x+5)}{2x+5} = 11 \frac{1}{9}$$

$$\Rightarrow \frac{x(x+5)}{2x+5} = \frac{100}{9}$$

$$\Rightarrow 9x^2 + 45x = 200x + 500$$

$$\Rightarrow 9x^2 + 45x - 200x - 500 = 0$$

$$\Rightarrow 9x^2 - 155x - 500 = 0$$

$$\Rightarrow 9x^2 - 180x + 25x - 500 = 0$$

$$\Rightarrow (x - 20)(9x - 25) = 0$$

$X = 20$ or $25/9$

So the first pipe fill s the tank in 20 minutes and the second pipe fills the tank in 25 minutes.

10) let the smallest angle = x

The greatest angle = x^2

The other angle = $2x$

$$X^2 + 2x + x = 180$$

$$\Rightarrow x^2 + 3x - 180 = 0$$

$$\Rightarrow (x + 15)(x - 12) = 0$$

$$X = -15 \text{ (not possible)}$$

$$\text{Or } x = 12$$

The angles are 120, 1440 and 240.

Exercise - 7



I. Use the method of substitution to solve each of the pair of simultaneous Equations.

A) $x + y = 15 \Rightarrow x = 15 - y$

$$x - y = 3$$

$$\Rightarrow 15 - y - y = 3$$

$$\Rightarrow 15 - 2y = 3$$

$$\Rightarrow -2y = 3 - 15$$

$$\Rightarrow Y = \frac{-12}{-2} = 6$$

$$X = 15 - y = 15 - 6 = 9$$

B) $x + y = 0$ so $x = -y$

$$x - y = 2$$

$$\Rightarrow -y - y = 2$$

$$\Rightarrow -2y = 2$$

$$\Rightarrow Y = -1$$

$$X = -(-1) = 1$$

c) $2x - y = 3$

$$\Rightarrow 2x = 3 + y$$

$$\Rightarrow x = \frac{3+y}{2}$$

$$4x + y = 3$$

$$\Rightarrow 4x + y = 3$$

$$\Rightarrow 2(3 + y) + y = 3$$

$$\Rightarrow 6 + 2y + y = 3$$

$$\Rightarrow 3y = 3 - 6$$

$$Y = \frac{-3}{3} = -1$$

d) $2x - 9y = 9 \Rightarrow 2x = 9 + 9y$

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

$$5x + 2y = 27$$

$$\Rightarrow 5 \times \frac{9+9y}{2} + 2y = 27$$

$$\Rightarrow \frac{45 + 45y + 4y}{2} = 27$$

$$\Rightarrow 45 + 49y = 54$$

$$\Rightarrow 49y = 54 - 45$$

$$\Rightarrow Y = \frac{9}{49}$$

$$X = \frac{9 + 9y}{2} = \frac{9 + 9 \times \frac{9}{49}}{2} = \frac{\frac{441 + 81}{49}}{2} = \frac{522}{49 \times 2} = \frac{522}{98} = 5.33$$

e) $x + 4y = -4 \Rightarrow x = -4 - 4y$

$$3y - 5x = -1$$

$$\Rightarrow 3y - 5 \times (-4 - 4y) = -1$$

$$\Rightarrow 3y + 20 + 20y = -1$$

$$\Rightarrow 23y = -1 - 20 = -21$$

$$\Rightarrow Y = \frac{-21}{23}$$

$$X = -4 - 4 \times \frac{-21}{23} = \frac{-92 + 84}{23} = \frac{-8}{23}$$

f) $2x - 3y = 2$

$$\Rightarrow 2x = 2 + 3y$$

$$\Rightarrow x = \frac{2 + 3y}{2}$$

$$X + 2y = 8$$

$$\Rightarrow \frac{2 + 3y}{2} + 2y = 8$$

$$\Rightarrow \frac{2 + 3y + 4y}{2} = 8$$

$$\Rightarrow 2 + 7y = 16$$

$$\Rightarrow 7y = 16 - 2 = 14$$

$$\Rightarrow Y = 2$$

$$X = \frac{2 + 3y}{2} = \frac{2 + 3 \times 2}{2} = 4$$

g) $x + y = 7$

$$\Rightarrow x = 7 - y$$

$$2x - 3y = 9$$

$$\Rightarrow 2(7 - y) - 3y = 9$$

$$\Rightarrow 14 - 2y - 3y = 9$$

$$\Rightarrow -5y = 9 - 14$$

$$\Rightarrow Y = 1$$

$$X = 7 - y = 7 - 1 = 6$$

H) $11y + 15x = -23$

$$\Rightarrow 15x = -23 - 11y$$

$$X = \frac{-23 - 11y}{15}$$

$$7y - 2x = 20$$

$$\Rightarrow 7y - 2 \times \frac{-23 - 11y}{15} = 20$$

$$\Rightarrow \frac{105y + 46 + 22y}{15} = 20$$

$$\Rightarrow 127y + 46 = 300$$

$$\Rightarrow Y = (300 - 46) \div 127 = 254 \div 127 = 2$$

$$X = \frac{-23 - 11y}{15} = \frac{-23 - 11 \times 2}{15} = \frac{-45}{15} = -3$$

I) $5x - 6y = 2$

$$\Rightarrow 5x = 2 + 6y$$

$$\Rightarrow x = \frac{2 + 6y}{5}$$

$$6x - 5y = 9$$

$$\Rightarrow 6 \times \frac{2 + 6y}{5} - 5y = 9$$

$$\Rightarrow \frac{12 + 36y - 25y}{5} = 9$$

$$\Rightarrow 12 + 11y = 45$$

$$\Rightarrow Y = (45 - 12) \div 11 = 3$$

$$X = \frac{2 + 6y}{5} = \frac{2 + 6 \times 3}{5} = 4$$

II. Solve each pair of equation given below using elimination method.

A) $x + 2y = -4$(1)
 $3x - 5y = -1$(2)
Equation (1) $\times$ 3
 $3x + 6y = -12$(3)
Equation (2) - (3)
 $-11y = -1 - (-12) = 11$
 $y = -1$
 $x = -4 - 2y = -4 - 2 \times (-1) = -4 + 2 = -2$

B) $4x + 9y = 5$(1)
 $-5x + 3y = 8$ (2)
Equation (2) $\times$ 3
 $-15x + 9y = 15$(3)
Equation (1) - (3)
 $4x - (-15x) = 5 - 15$
 $\Rightarrow 4x + 15x = -10$
 $\Rightarrow 19x = -10$
 $\Rightarrow x = \frac{-10}{19}$
 $4x + 9y = 5$
 $4 \times \frac{-10}{19} + 9y = 5$
 $\Rightarrow \frac{-40}{19} + 9y = 5$
 $\Rightarrow 9y = 5 + \frac{40}{19} = \frac{85 + 40}{19} = \frac{125}{19}$
 $\Rightarrow y = \frac{125}{19 \times 9} = \frac{125}{171}$

c) $9x - 6y = 12$(1)
 $4x + 6y = 14$(2)
Equation (1) + (2)
 $13x = 26$
 $x = 2$

$$4x + 6y = 14$$

$$\Rightarrow 4 \times 2 + 6y = 14$$

$$\Rightarrow 6y = 14 - 8 = 6$$

$$\Rightarrow y = 1$$

$$\text{D) } 2y - \frac{3}{x} = 12 \quad \dots\dots\dots (1)$$

$$5y + \frac{7}{x} = 1 \quad \dots\dots\dots (2)$$

$$\text{Equation (1)} \times 7$$

$$14y - \frac{21}{x} = 84 \quad \dots\dots\dots (3)$$

$$\text{Equation (2)} \times 3$$

$$15y + \frac{21}{x} = 3 \quad \dots\dots\dots (4)$$

$$\text{Equation (3)} + (4)$$

$$29y = 87$$

$$y = 3$$

$$2y - \frac{3}{x} = 12$$

$$\Rightarrow 2 \times 3 - \frac{3}{x} = 12$$

$$\Rightarrow -\frac{3}{x} = 12 - 6 = 6$$

$$\Rightarrow x = -\frac{3}{6} = -\frac{1}{2}$$

$$\text{e) } \frac{3}{x} + \frac{2}{y} = \frac{9}{xy}$$

$$\Rightarrow \frac{3y + 2x}{xy} = \frac{9}{xy}$$

$$\Rightarrow 2x + 3y = 9 \dots\dots\dots (1)$$

$$\frac{9}{x} + \frac{4}{y} = \frac{21}{xy}$$

$$\Rightarrow \frac{9y + 4x}{xy} = \frac{21}{xy}$$

$$4x + 9y = 21 \dots\dots\dots (2)$$

$$\text{Equation (1)} \times 2$$

$$4x + 6y = 18 \dots\dots\dots(3)$$

Equation (2) - (3)

$$3y = 3$$

$$y = 1$$

$$2x + 3y = 9$$

$$\Rightarrow 2x + 3 \times 1 = 9$$

$$x = 3$$

$$F) \quad \frac{4}{y} + \frac{3}{x} = 8 \quad \dots\dots\dots(1)$$

$$\frac{6}{y} + \frac{5}{x} = 13 \quad \dots\dots\dots(2)$$

Equation (1) $\times$ 5

$$\frac{20}{y} + \frac{15}{x} = 40 \quad \dots\dots\dots(3)$$

Equation (2) $\times$ 3

$$\frac{18}{y} + \frac{15}{x} = 39 \quad \dots\dots\dots(4)$$

Equation (3) - (4)

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

$$y = 2$$

Putting value of y in equation 1

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

$$\Rightarrow \frac{4}{2} + \frac{3}{x} = 8$$

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

$$\therefore x = \frac{3}{6} = \frac{1}{2}$$

$$g) \quad 5x + \frac{4}{y} = 7 \quad \dots\dots\dots(1)$$

$$4x + \frac{3}{y} = 5 \quad \dots\dots\dots(2)$$

Equation (1) $\times$ 3

$$15x + \frac{12}{y} = 21 \quad \dots\dots\dots(3)$$

Equation (2) $\times$ 4

$$16x + \frac{12}{y} = 20 \quad \dots\dots\dots(4)$$

Equation (4) - (3)

$$x = -1$$

Replacing x value in equation (1)

$$16x + \frac{12}{y} = 20$$

$$\Rightarrow 5(-1) + \frac{4}{y} = 7$$

$$\Rightarrow \frac{4}{y} = 7 + 5 = 12$$

$$\Rightarrow y = \frac{4}{12} = \frac{1}{3}$$

H) $x + y = 3 \dots\dots\dots(1)$

$$-3x + 2y = 1 \dots\dots\dots(2)$$

Equation (1) $\times$ 3

$$3x + 3y = 9 \dots\dots\dots(3)$$

Equation (2) + (3)

$$5y = 10$$

$$y = 5$$

Replacing the value of y in equation (1)

$$x + y = 3$$

$$x = 3 - y = 3 - 5 = -2$$

i) $-3x + 2y = 5 \dots\dots\dots(1)$

$$4x + 5y = 2 \dots\dots\dots(2)$$

Equation (1) $\times$ 4

$$-12x + 8y = 20 \dots\dots\dots(3)$$

Equation (2) $\times$ 3

$$12x + 15y = 6 \dots\dots\dots(4)$$

Equation (3) + (4)

$$23y = 26$$

$$y = \frac{26}{23}$$

$$-3x + 2 \times \frac{26}{23} = 5$$

$$\Rightarrow -3x = 5 - \frac{52}{23} = \frac{115 - 52}{23} = \frac{63}{23}$$

$$X = \frac{63}{23 \times -3} = -\frac{21}{23}$$

III. Solve the following simultaneous equations.

a) $3a + 4b = 43$[1]

$-2a + 3b = 11$[2]

Solve equation [2] for the variable b

$$3b = 2a + 11$$

$$b = 2a/3 + 11/3$$

replace variable b in equation [1]

$$3a + 4(2a/3 + 11/3) = 43$$

$$17a/3 = 85/3$$

$$17a = 85$$

Solve equation [1] for the variable a

$$17a = 85$$

$$a = 5$$

Use the a value to solve for b

$$b = (2/3)(5) + 11/3 = 7$$

B $4x - 3y = 23$(1)

$3x + 4y = 11$(2)

Equation (1) $\times$ 3

$$12x - 9y = 69$$
.....(3)

$$12x + 16y = 44$$
.....(4)

Equation (3) - (4)

$$-25y = 25$$

$$y = -1$$

$$4x - 3y = 23$$

$$\Rightarrow 4x = 23 + 3 \times (-1) \quad \Rightarrow \quad x = 20/4 = 5$$

$$\text{c) } 5x + \frac{4}{y} = 7 \dots\dots\dots(1)$$

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

Equation (1) $\times$ 3

$$15x + \frac{12}{y} = 21 \dots\dots\dots(3)$$

Equation (2) $\times$ 4

$$16x + \frac{12}{y} = 20 \dots\dots\dots(4)$$

Equation (4) - (3)

$$x = -1$$

Replacing x value in equation (1)

$$5x + \frac{4}{y} = 7$$

$$\Rightarrow 5(-1) + \frac{4}{y} = 7$$

$$\Rightarrow \frac{4}{y} = 7 + 5 = 12$$

$$y = \frac{4}{12} = \frac{1}{3}$$

$$\text{d) } 3x + 2y = 8 \dots\dots\dots(1)$$

$$4x + y = 9 \dots\dots\dots(2)$$

Equation (1) $\times$ 4

$$12x + 8y = 32 \dots\dots\dots(3)$$

Equation (2) $\times$ 3

$$12x + 3y = 27 \dots\dots\dots(4)$$

Equation (3) - (4)

$$5y = 5$$

$$y = 1$$

$$4x + y = 9$$

$$x = (9 - y)/4 = (9 - 5)/4 = 1$$

$$\text{e) } x - y = -1 \dots\dots\dots(1)$$

$$2y + 3x = 12 \dots\dots\dots(2)$$

$$\text{Equation (1)} \times 3$$

$$3x - 3y = -3 \dots\dots\dots(3)$$

$$\text{Equation (2)} - (3)$$

$$5y = 15$$

$$y = 3$$

$$x - y = -1$$

$$x = -1 + y = -1 + 3 = 2$$

$$\text{f) } \frac{3y}{2} - \frac{5x}{3} = -2$$

$$\Rightarrow 9y - 10x = -12 \dots\dots\dots(1)$$

$$\frac{y}{3} + \frac{x}{3} = \frac{13}{6}$$

$$\Rightarrow x + y = \frac{39}{6}$$

$$\Rightarrow 6x + 6y = 39 \dots\dots\dots(2)$$

$$\text{Equation (1)} \times 2$$

$$18y - 20x = -24 \dots\dots\dots(3)$$

$$\text{Equation (2)} \times 3$$

$$18x + 18y = -72 \dots\dots\dots(4)$$

$$\text{Equation (3)} - (4)$$

$$-38x = 48$$

$$x = -\frac{48}{38}$$

$$x + y = \frac{39}{6}$$

$$y = \frac{39}{6} - -\frac{48}{38} = \frac{39}{6} + \frac{48}{38} = \frac{741+144}{114} = \frac{885}{114} = 7.76$$

$$\text{g) } x - y = 3 \dots\dots\dots(1)$$

$$\frac{x}{3} + \frac{y}{2} = 6$$

$$2x + 3y = 36 \dots\dots\dots(2)$$

$$\text{Equation (1)} \times 2$$

$$2x - 2y = 6 \dots\dots\dots(3)$$

Equation (2) - (3)

$$5y = 30$$

$$y = 6$$

$$x = 3 + y = 3 + 6 = 9$$

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

$$\Rightarrow 4x + 3y = -6 \dots\dots\dots(1)$$

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

$$\Rightarrow x + 3y = 9 \dots\dots\dots(2)$$

Equation (1) - (2)

$$3x = -15$$

$$x = -5$$

$$x + 3y = 9$$

$$y = (9 - x) / 3 = 14 / 3 = 4\frac{2}{3}$$

i) $5x + 8y = 9 \dots\dots\dots(1)$

$$2x + 3y = 4 \dots\dots\dots(2)$$

Equation (1) $\times 2$

$$10x + 16y = 18 \dots\dots\dots(3)$$

Equation (2) $\times 5$

$$10x + 15y = 20 \dots\dots\dots(4)$$

Equation (3) - (4)

$$y = -2$$

$$2x + 3y = 4$$

$$2x = 4 - 3y = 4 - 3(-2) = 4 + 6 = 10$$

$$x = 10 / 2 = 5$$

j) $3 - 2(3a - 4b) = -59$

$$\Rightarrow 3 - 6a + 8b = -59$$

$$\Rightarrow 8b - 6a = -59 - 3 = -62 \dots\dots\dots(1)$$

$$\frac{a-3}{4} - \frac{b-4}{5} = \frac{21}{10}$$

$$\Rightarrow 5(a-3) - 4(b-4) = \frac{21}{10} \times 20 = 42$$

$$\Rightarrow 5a - 15 - 4b + 16 = 42$$

$$\Rightarrow 5a - 4b = 42 - 1 = 41 \dots\dots\dots(2)$$

Equation (2) $\times$ 2

$$10a - 8b = 82 \dots\dots\dots(3)$$

Equation (1) + (3)

$$4a = 20$$

$$A = 20 \div 4 = 5$$

$$10a - 8b = 82$$

$$\Rightarrow 10 \times 5 - 8b = 82$$

$$\Rightarrow -8b = 82 - 50 = 32$$

$$B = 32 \div (-8) = -4$$

k) Data in-sufficient

l) Data in-sufficient

m) Data in-sufficient

n) Data in-sufficient

IV) Passage type questions.

1) **Ans : a**

$$X + y = 3$$

$$3x + 3y = 9 \dots\dots\dots(1)$$

$$3x - 2y = 4 \dots\dots\dots(2)$$

Equation (1) - (2)

$$5y = 5$$

$$y = 1$$

$$X = 3 - 1 = 2$$

2) **Ans : c**

$$3x - y = 2 \text{ (multiply both sides by 3)}$$

$$9x - 3y = 6$$

So both the equations are equal. There are infinite solutions to the equations.

3) **Ans : d**

$$2x + 4y = 10$$

$$3x + 6y = 12$$

$$6x + 12y = 30$$

$$6x + 12y = 24$$

The system of equations have no solution.

4) **Ans : a**

$$3x - 2y = 5$$

$$3x = 5 + 2y$$

$$x = (5 + 2y) / 3$$

X	3	$\frac{1}{2}$
y	2	-2

Application Skill Achiever



1) Let the numbers are x and y

$$x + y = 14$$

$$x - y = 2$$

$$\therefore 2x = 16$$

$$x = 8$$

$$y = 14 - 8 = 6$$

The numbers are 8 and 6

2) Let the units digit is x and the tens digit is y

$$x = 3y$$

$$\Rightarrow x - 3y = 0 \dots\dots\dots(1)$$

Again:

$$10y + x + 36 = 10x + y$$

$$\Rightarrow 9y - 9x = -36$$

$$\Rightarrow y - x = -4 \dots\dots\dots(2)$$

Equation (1) + (2)

$$-2y = -4 \quad \therefore y = 2$$

$$x = 3 \times 2 = 6$$

The number is 26

3) Let the numerator is = x

And the denominator = y

$$\therefore (x + 2)/(y + 2) = 9/10$$

$$\Rightarrow 10x + 20 = 9y + 18$$

$$\Rightarrow 10x - 9y = -2 \dots\dots\dots(1)$$

Again:

$$(x - 3) / (y - 3) = 4/5$$

$$\Rightarrow 5x - 15 = 4y - 12$$

$$\Rightarrow 5x - 4y = 3 \dots\dots\dots(2)$$

Equation (2) $\times$ 2

$$10x - 8y = 6 \dots\dots\dots(3)$$

Equation (1) (3)

$$-y = -8$$

$$\therefore y = 8$$

$$x = (-2 + 9y)/10 = (-2 + 9 \times 8)/10 = 7$$

4) Let the father's age = x

The son's age = y

$$x + 2y = 56 \dots\dots\dots(1)$$

$$2x + y = 82 \dots\dots\dots(2)$$

$$\text{Equation (1)} \times 2 = 2x + 4y = 112 \dots\dots\dots(3)$$

Equation (2) - (3)

$$-3y = -30 \therefore y = 10$$

$$x = 56 - 2y = 56 - 2 \times 10 = 36$$

The father's age is 36 years and the son's age is 10 years.

5) Let the cost of a pen = x

Cost of an eraser = y

$$2x + y = 35 \dots\dots\dots(1)$$

$$3x + 4y = 65 \dots\dots\dots(2)$$

$$\text{Equation (1)} \times 4 = 8x + 4y = 140 \dots\dots\dots(3)$$

$$\text{Equation (2) - (3)} = -5x = -75$$

$$\therefore x = 15$$

$$y = 35 - 2x = 35 - 30 = 5$$

The cost of a pen is Rs. 15 and cost of an eraser is Rs. 5.

6) Let the cost of an audio cassette = x

The cost of a video cassette = y

$$7x + 3y = 1110 \dots\dots\dots(1)$$

$$5x + 4y = 1350 \dots\dots\dots(2)$$

$$\text{Equation (1)} \times 4 = 28x + 12y = 4440 \dots\dots\dots(3)$$

$$\text{Equation (2)} \times 3 = 15x + 12y = 4050 \dots\dots\dots(4)$$

$$\text{Equation (3)} - (4)$$

$$13x = 390$$

$$\therefore x = \text{Rs. } 30$$

$$y = (1110 - 7x)/3 = (1110 - 210)/3 = \text{Rs. } 300$$

The cost of an audio cassette is Rs. 30 and the cost of a video cassette is Rs. 300.

7) Let the father's present age = x

The son's present age = y

$$x - 2 = (y - 2) \times 5$$

$$\Rightarrow x - 2 = 5y - 10$$

$$\Rightarrow x - 5y = -8 \dots\dots\dots(1)$$

Again:

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

$$\Rightarrow x + 2 = 3y + 6 + 8$$

$$\Rightarrow x - 3y = 12 \dots\dots\dots(2)$$

$$\text{Equation (1)} - (2)$$

$$-2y = -20$$

$$\therefore y = 10$$

$$x = 12 + 3y = 12 + 3 \times 10 = 12 + 30 = 42$$

The present age of the father is 42 years and the present age of the son is 10 years.

Exercise - 8



i. Fill in the blanks with the correct answer.

Ans : 1) $b - \frac{\sqrt{3}}{2}a$

2) c - Hypotenuse

3) c - 2

4) $a - \sqrt{s(s-a)(s-b)(s-c)}$

5) b - 4

6) c - 2

7) a - Equal 8) $c - \sqrt{\text{length}^2 + \text{breadth}^2}$

9) c - Equal

10) c - Square

Application Skill Achiever



I. Choose the correct answer.

Ans : 1) $2b^2 = h^2$

2) 44%

3) 12cm

4) 440

5) 204

6) $37\frac{1}{2}\%$

7) 5m

8) 82%

9) 56m

II. Answer the following questions.

1) the length of the rope = 21m

$$\text{The area the horse can graze} = \frac{1}{4} \times \pi r^2 = \frac{1}{4} \times \frac{22}{7} \times 21 \times 21 = 346.5\text{m}^2$$

2) area of the square = 5 inch $\times$ 5 inch = 25 square inch

Area of the square grid = 1 inch $\times$ 1 inch = 1 square inch

Number of squares = 25 square inch $\div$ 1 square inch = 25

3) area of the circle before increasing = πr^2

$$\text{Area of the circle after increasing} = \pi \times 2r \times 2r = 4\pi r^2$$

$$\text{area increased in percentage} = \frac{(4\pi r^2 - \pi r^2)}{\pi r^2} \times 100 = 300\%$$

4) let the equal sides of the isosceles right angled triangle = a

$$\text{Hypotenuse} = \sqrt{2}a$$

$$\text{Perimeter} = a + a + \sqrt{2}a = 2a + 2a = a(2 + \sqrt{2})$$

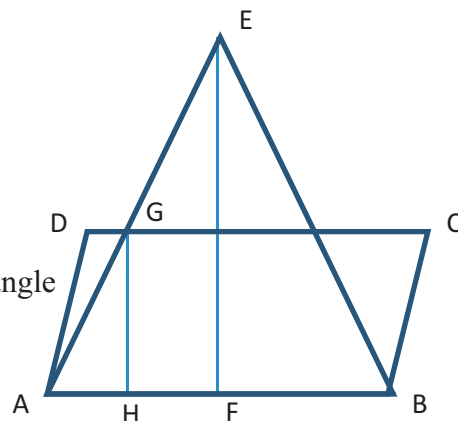
$$a(2 + \sqrt{2}) = 6 + 3\sqrt{2}$$

$$a = (6 + 3\sqrt{2}) \div (2 + \sqrt{2}) = 3$$

The area of the triangle = $\frac{1}{2} \times 3 \times 3 = 4.5$ square units

5) According the question area of parallelogram = area of the triangle

$$\text{So } AB \times GH = \frac{1}{2} \times AB \times EF$$



$$\Rightarrow GH = \frac{1}{2} EF$$

$$\Rightarrow EF = 2 \times GH$$

$$GH = 100\text{m}$$

$$\text{So } EF = 2 \times 100\text{m} = 200\text{m}$$

The altitude of the triangle is 200m.

- 6) The rhombus OABC is inside the circle whose center is O
So the sides of the rhombus is equal to the radius of the circle

$$\text{The area of the rhombus} = \frac{\sqrt{3}}{2} a^2$$

$$\frac{\sqrt{3}}{2} a^2 = 32\sqrt{3}$$

$$\Rightarrow a^2 = 32\sqrt{3} \times \frac{2}{\sqrt{3}} = 64$$

$$\therefore a = \sqrt{64} = 8\text{m.}$$

The radius of the circle is 8m.

- 7) The sides of the square = 14cm

The radius of the circles = $\frac{7}{4}$ cm

Area inside the circumference of the circles = area of the four circles

$$= 4 \times \frac{22}{7} \times \frac{7}{4} \times \frac{7}{4} = \frac{154}{4} = 38.5\text{cm}^2$$

- 8) The diagonal of the rectangular floor = 5 m.

The shorter side is 3m.

$$\text{Length} = \sqrt{5^2 - 3^2} = \sqrt{25 - 9} = \sqrt{16} = 4\text{m}$$

$$\text{The area of the closet} = 4\text{m} \times 3\text{m} = 12\text{m}^2$$

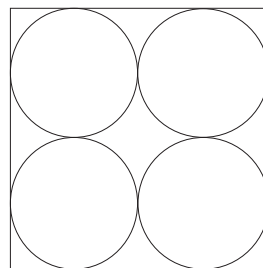
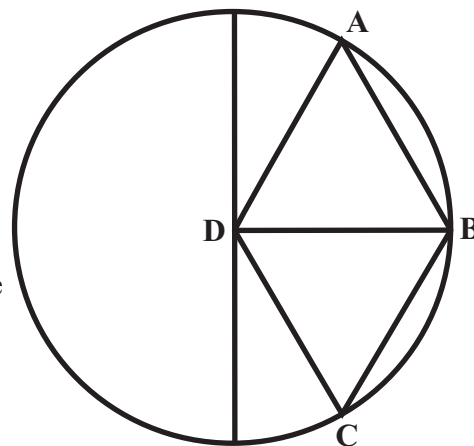
- 9) the length of the square = $\frac{3x}{4} + 1 = \frac{3x+4}{4}$

$$\text{The perimeter of the square} = \frac{3x+4}{4} \times 4 = 3x+4$$

- 10) sides of the square = 10m.

$$\text{Area of the square} = 10\text{m} \times 10\text{m} = 100\text{m}^2$$

$$\text{Area of the shaded region} = \left(\frac{1}{2} \times \frac{22}{7} \times 10 \times 10 \right) - 100$$



$$= \frac{2200}{14} - 100 = \frac{2200 - 1400}{14} = \frac{800}{14} = 57.14 m^2$$

- 11) $AB = 10$

$$\text{BC} = 20$$

$$OC^2 = CQ^2 + CP^2$$

$$r^2 = (r - 10)^2 + (r - 20)^2$$

$$\Rightarrow r^2 = r^2 + 100 - 20r + r^2 + 400 - 40r$$

$$\Rightarrow r^2 = 2r^2 + 500 - 60r$$

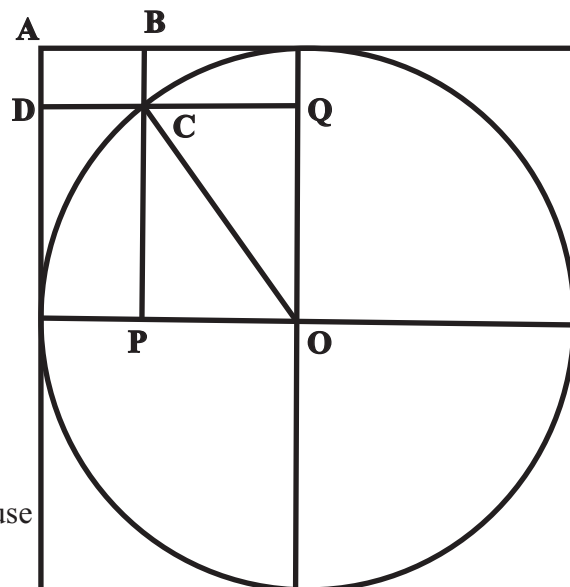
$$\Rightarrow r^2 - 60r + 500 = 0$$

$$\Rightarrow (r - 50)(r - 10) = 0$$

R is either 50 or 10 but r cannot be 10 because

if must be More than BC

So $r = 50\text{cm}$.



Exercise - 9



I. Fill in the blanks with the correct option.

- Ans : 1) b - volume 2) a - equal 3) b - side of the base
 4) a - $\sqrt{3}$ 5) b - $L \times B \times H$ 6) b - $2\pi rh$
 7) a - $\pi r^2 h$ 8) b - $\frac{1}{3}\pi r^2 h$ 9) a - 4
 10) c - $\frac{1}{3} \times \text{area of base} \times \text{height}$ 11) b - $\frac{\pi h}{3}(R^2 + Rr + r^2)$

Application Skill Achiever



I. Choose the correct answer.

- Ans : 1) c - 16cm^2 2) c - 1200m^3 3) a - 84m. 4) b - 3.696kg.
 5) b - 60kg. 6) b - 25cm 7) 188.6m^2 8) a - 49m^2
 9) b - 5120 10) b - 7 : 3

II. Answer the following questions.

- 1) the capacity of the cistern = 8000 liters

The external measures of the cistern = 3.3m., 2.6m. and 1.1m.

Volume of outer walls = $2 \times \text{thickness}(\text{lh} + \text{bh})$

$$= 2 \times .05 (3.3 \times 1.1 + 2.6 \times 1.1) = .1(3.63 + 2.86) = .649\text{m}^3$$

$$\text{volume of the bottom} = 3.3\text{m.} \times 2.6\text{m.} \times 1.1\text{m.} - .649\text{m}^3 - 8\text{m}^3$$

$$= 9.438 - 8.649 = 0.789\text{m}^3$$

Thickness of the bottom = volume of bottom $\div$ ((length) (breadth))

$$= \frac{.789}{3.3 \times 2.6} = 0.091\text{m.} = 9.1\text{cm.}$$

- 2) volume of the cone = $\frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 14 = 718.66\text{cm}^3$

- 3) total volume of the smaller cubes = $3^3 + 4^3 + 5^3 = 27 + 64 + 125 = 216$

$$\text{Sides of the big cube} = \sqrt[3]{216} = 6\text{cm.}$$

$$\text{Total surface area of the smaller cubes} = 6(3^2 + 4^2 + 5^2) = 150\text{cm}_2$$

$$\text{Total surface area of the big cube} = 6 \times 6^2 = 216\text{m}^2$$

$$\text{Their ratio} = 150 : 216 = 25 : 36$$

$$4) \text{ The number of bricks needed} = \frac{800 \times 600 \times 22.5}{25 \times 11.25 \times 6} = 6400$$

$$5) \text{ The number of bricks needed} = \frac{600 \times 500 \times 50 \times .95}{25 \times 12.5 \times 7.5} = \frac{14250000}{2343.75} = 6080$$

$$6) \text{ The weight of the miniature cuboid} = \frac{16}{4 \times 4 \times 4} = \frac{1}{4} \text{ kg} = 250 \text{ gm.}$$

$$7) \text{ area of the plate} = \frac{66}{.05} = 1320 \text{ cm}^2$$

$$5x^2 = 1320 \text{ cm}^2$$

$$X = \sqrt{\frac{1320}{5}} = \sqrt{264} = 16.25 \text{ cm}$$

The sides of the sheet is 16.25 cm and 81.25 cm

$$8) \text{ The length of the wire} = \frac{\text{volume}}{\text{CrossSectionArea}} = \frac{66}{\pi \times .05 \times .05} = 8400 \text{ cm} = 84 \text{ m.}$$

$$9) \text{ total surface area of the metallic box} = 2r(h + r) \\ = 2 \times \frac{22}{7} \times .35(1.25 + .35) = 2 \times \frac{22}{7} \times .35 \times 1.60 = 3.52 \text{ m}^2$$

$$\text{Cost of the material used} = 3.52 \times 80 = \text{Rs. } 281.60$$

$$10) \frac{d^2}{D^2} = \frac{100}{400}$$

$$d = \frac{D}{4}$$

$$d^3 = D^3 - \frac{KD^3}{100} \Rightarrow \frac{D^3}{64} = D^3 - \frac{KD^3}{100} \Rightarrow \frac{1}{64} = 1 - \frac{k}{100}$$

$$K = \left(1 - \frac{1}{64}\right) 100 = \frac{63}{64} \times 100 = 98.4$$

11) The surface area of the three cotermious faces of a cuboid are 6, 15, 10 sq.cm respectively. Find the volume of the cuboid.

Sol: Let the sides of the cuboid be a, b, and c.

Given: a b = 6; bc = 15; ca = 10

To find volume V = abc

Multiply all three:

$$\Rightarrow (ab)(bc)(ca) = (abc)^2$$

$$\Rightarrow 6 \times 15 \times 10 = (abc)^2 \Rightarrow 900 = (abc)^2 \Rightarrow abc = \sqrt{900} = 30$$

Ans: Volume = 30 cubic cm

12) The radius of two cylinders are in the ratio 2:3 and their heights in the ratio 3:4. Find the ratio of their volumes.

Sol: Formula for volume of a cylinder: $V = \pi r^2 h$

Let: Radius of cylinders be $r_1 : r_2 = 2 : 3$

Height $h_1 : h_2 = 3 : 4$

$$\text{Then: Volume ratio} = \frac{r_1^2 h_1}{r_2^2 h_2} = \frac{(2)^2 \times 3}{(3)^2 \times 4} = \frac{12}{36} = \frac{1}{3}$$

Ans: 1 : 3

13) The edge of a cube is 20 cm. How many small cubes of 5 cm edge can be formed from this cube?

Sol: Volume of large cube: $= 20^3 = 8000 \text{ cm}^3$

Volume of small cube: $= 5^3 = 125 \text{ cm}^3$

Number of small cubes $= 8000/125 = 64$

Ans: 64 small cubes

Exercise - 10



I. Choose the correct answer.

- Ans : 1) $c - \tan \theta$ 2) $b - \frac{5}{4}$ 3) $a - 0$ 4) $c - 2\sqrt{2}$
 5) $a - \frac{a}{b}$ 6) $c - \sqrt{h^2 + k^2}$ 7) $c - 2x - 3y - 12 = 0$ 8) $\left[\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right]$
 9) (C) $x = y$ 10) (B) y axis

II. Reasoning type questions.

- 1) **Ans:** a (Both A and R are correct and R is the correct explanation of A)
 2) **Ans:** none of these, because both the statements are wrong.
 3) **Ans:** a (Both A and B are true)

III. Passage

- 1) **Ans:** a (4,2)
 2) **Ans:** b (2,2)
 3) **Ans:** c (0, -4)

IV. Match the following.

- Ans:** 1) b 2) a 3) d 4) c

Application Skill Achiever



I. Choose the correct answer.

- Ans :** 1) (B) $y = 0$ 2) (D) $-5/4$ 3) (D) $(-2, -3)$
 4) (B) $y = 8, y = 4$ 5) (B) $(0, c)$ 6) (A) a right triangle
 7) (C) $y = x$ 8) (D) $x = 8, y = 4$ 9) (C) $2y = x$
 10) (D) $\pi/3$ 11) (A) $(2,3)$ 12) (B) 1
 13) (D) none of these