

MARKING GUIDE FOR CSSC 2026

BASIC MATHEMATICS

1. (a) Club Meetings

We need the **Least Common Multiple (LCM)** of 12, 18 and 30 which is 180.

The three clubs will all meet again after **180 days**.

(b) Packing Gift Boxes

The greatest number of boxes is the Highest Common Factor (HCF) of 48 and 72 which is 24.

The greatest number of boxes he can make is **24**.

Each box contains $\frac{48}{24}$ juice bottles = 2

and $\frac{72}{24}$ biscuit packets = 3

2 (a) Exponential Equation

Given $3^{2y-1} + 2 \cdot 3^{y-1} = 1$

and $P = 3^y$

Express the equation in terms of P .

Step 1: Rewrite each term

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

Also,

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

Step 2: Substitute

$$\frac{P^2}{3} + \frac{2P}{3} = 1$$

Multiply by 3:

$$P^2 + 2P = 3$$

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

2 (a) Step 3: Factorize

$$(P + 3)(P - 1) = 0$$

Hence

$$P = -3 \text{ or } P = 1$$

Since

$$P = 3^y > 0$$

$$P = 1$$

Step 4: Find y

$$3^y = 1$$

Therefore, $y = 0$

2 (b) Logarithms

Given $\log_{10}(2y + 5) - 1 = \log_{10}(y - 3)$

But, $1 = \log_{10} 10$

Therefore

$$\log_{10}(2y + 5) - \log_{10} 10 = \log_{10}(y - 3)$$

$$\log_{10} \left(\frac{2y+5}{10} \right) = \log_{10}(y - 3)$$

Equate arguments

$$\frac{2y+5}{10} = y - 3$$

$$2y + 5 = 10y - 30$$

$$35 = 8y$$

$$\therefore y = \frac{35}{8} \text{ or } y = 4.375$$

3 (a) Sets

Total trainees = 100

Accounting = 60

Economics = 45

Neither = 20

(i) Venn Diagram Information

Number studying at least one subject:

$$100 - 20 = 80$$

Let x be those studying both.

Using set formula:

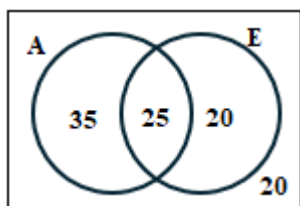
$$n(A \cup E) = n(A) + n(E) - n(A \cap E)$$

$$80 = 60 + 45 - x$$

$$80 = 105 - x$$

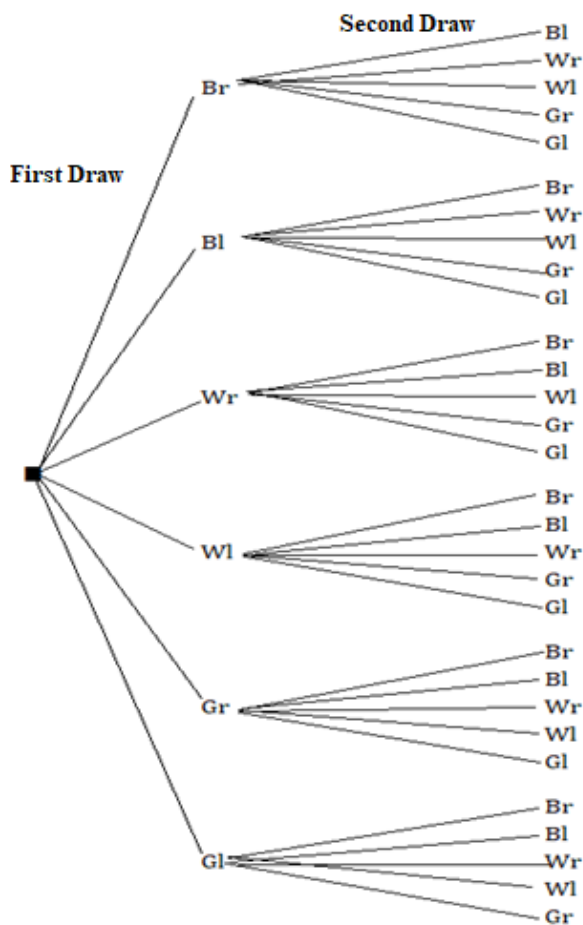
$$x = 25$$

Venn Diagrams



subjects=25.

(b) Probability



3 (b) Let Br and Bl be Blue socks of right foot and left foot respectively.

According to tree diagram above, each first draw of socks has a chance of $1/6$, and the second draw has $1/5$.

Therefore:

(i) Matched pair is:

$$\text{Br and Bl} = \frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$$

$$\text{Or Wr and Wl} = \frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$$

$$\text{Or Gr and Gl} = \frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$$

$$\text{Probability is } \frac{1}{30} + \frac{1}{30} + \frac{1}{30} = \frac{1}{10}$$

(ii) Same feet is: rr or ll (Both right or left foot)

Possibilities are: (Br and Wr) or (Br and Gr)

Or (Bl and Wl) or (Bl and Gl) or (Wr and Br)

or (Wr and Gr) or (Wl and Bl) or (Wl and Gl) or

(Gr and Br) or (Gr and Wr) or (Gl and Bl)

or (Gl and Wl)

Note: each bracket has chance $\frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$

Therefore, **probability is** $\frac{1}{30} \times 12 = \frac{2}{5}$

4 (a) Coordinate Geometry

Road R_1 is given by:

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

Rewrite in slope-intercept form:

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

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

Therefore, slope of R_1 is:

$$m_1 = -3/2$$

4 (a) Since R_2 is perpendicular to R_1 :

$$m_1 \times m_2 = -1$$

$$(-3/2)m_2 = -1$$

$$m_2 = 2/3$$

Road R_2 passes through (2,3).

Using point-slope form:

$$y - 3 = (2/3)(x - 2)$$

$$3y - 9 = 2x - 4$$

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

Equation of R_2 : $2x - 3y + 5 = 0$

4(b)

Boat velocity relative to water:

20 km/h due north

River current:

8 km/h due west

Represent as vectors:

$$V = (-8, 20)$$

Magnitude of resultant velocity:

$$|V| = \sqrt{(-8)^2 + 20^2}$$

$$= \sqrt{64 + 400}$$

$$= \sqrt{464}$$

$$\approx 21.54 \text{ km/h}$$

Direction:

$$\tan \theta = 8/20$$

$$\theta = \tan^{-1}(0.4)$$

$$\approx 21.80^\circ$$

Therefore the boat moves:

21.54 km/h, 21.80° west of north

5(a) Length ratio:

$$10 : 5 = 2 : 1$$

Area ratio:

$$2^2 : 1^2 = 4 : 1$$

Area of larger garden:

$$= 40 \times 4 = 160 \text{ cm}^2$$

Area of the larger garden = 160 cm^2

5(b) Let exterior angle = x

Interior angle = $5x$

$$\text{Exterior} + \text{Interior} = 180^\circ$$

$$x + 5x = 180^\circ$$

$$6x = 180^\circ$$

$$x = 30^\circ$$

Number of sides:

$$n = 360^\circ / 30^\circ$$

$$= 12$$

The polygon has 12 sides.

6(a) Original wire length = 15 m

Removed length = 6.2 m

Remaining length:

$$15 - 6.2 = 8.8 \text{ m}$$

Convert to centimeters:

$$8.8 \text{ m} = 880 \text{ cm}$$

Each piece = 40 cm

Number of pieces:

$$880 \div 40$$

$$= 22$$

Number of pieces formed = 22

6(b) Mass varies directly as breadth and inversely as length.

$$M = kb/l$$

$$\text{Given: } 80 = k(4)/10$$

$$80 = 2k/5, k = 200$$

For breadth = 6 m and length = 15 m:

$$M = (200 \times 6)/15 = 1200/15 = 80 \text{ kg}$$

Mass supported = 80 kg

7. (a) Cost price per book

John bought 48 books for Tsh 480,000.

$$\text{Cost per book} = \frac{480,000}{48} = 10,000$$

So each book cost Tsh 10,000.

First phase: He sold 25% of 48 books:

$$\frac{25}{100} \times 48 = 12 \text{ books}$$

Cost of 12 books:

$$12 \times 10,000 = 120,000$$

Sold at 20% profit:

$$120,000 \times 1.20 = 144,000$$

Revenue from first phase = Tsh 144,000

$$\text{Books remaining: } 48 - 12 = 36$$

Second phase: He sold 50% of the remaining 36 books:

$$\frac{50}{100} \times 36 = 18 \text{ books}$$

$$\text{Cost of 18 books: } 18 \times 10,000 = 180,000$$

$$\text{Sold at 10% profit: } 180,000 \times 1.10 = 198,000$$

Revenue from second phase = Tsh 198,000

$$\text{Books remaining: } 36 - 18 = 18$$

Third phase: He sold one-third of the remaining 18 books:

$$\frac{1}{3} \times 18 = 6 \text{ books}$$

$$7 \text{ (a) Cost of 6 books: } 6 \times 10,000 = 60,000$$

$$\text{Sold at 10% loss: } 60,000 \times 0.90 = 54,000$$

Revenue from third phase = Tsh 54,000

$$\text{Books remaining: } 18 - 6 = 12$$

Books given away

The remaining 12 books were given free.

$$\text{Cost of these books: } 12 \times 10,000 = 120,000$$

Revenue from them = 0

6. Total revenue

$$144,000 + 198,000 + 54,000 = 396,000$$

Total revenue = Tsh 396,000

Overall profit or loss

Total cost: 480,000

Total revenue: 396,000

$$\text{Loss} = 480,000 - 396,000 = 84,000$$

Therefore, John incurred an overall loss of Tsh 84,000.

(b) Mtweve's Trial Balance

Account Name	Dr	Cr
Cash	82000	
Capital		100000
Purchases	80000	
Sales		90000
Telephone bills	28000	
	<u>190000</u>	<u>190000</u>

$$8 \text{ (a) Number of seedlings} = 10$$

Distance between consecutive seedlings = 6 m

$$\text{Number of gaps: } = 10 - 1 = 9$$

$$\text{Total length: } = 9 \times 6 = 54 \text{ m}$$

The total length occupied is 54 metres.

8 (b) Given: 5th term = 162, 4th term = 54

For a geometric progression:

$$r = \frac{T^5}{T^4} = \frac{162}{54} = 3$$

Common ratio = 3

Let first term be a.

$$T_4 = ar^3$$

$$54 = a(3^3)$$

$$54 = 27a$$

$$a = \frac{54}{27}$$

$$a = 2$$

First term = **2 bacteria**

9 (a) Using the cosine addition formula:

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

Let $A = 90^\circ$ and $B = \theta$.

$$\cos(90^\circ + \theta) = \cos 90^\circ \cos \theta - \sin 90^\circ \sin \theta$$

$$= (0)(\cos \theta) - (1)(\sin \theta)$$

$$= -\sin \theta$$

Answer: $\cos(90^\circ + \theta) = -\sin \theta$

(b) Given: $a = 6$ m, $b = 8$ m

Included angle = 60°

Using cosine rule:

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

$$c^2 = 6^2 + 8^2 - 2(6)(8)\cos 60^\circ$$

$$c^2 = 36 + 64 - 96(1/2)$$

$$c^2 = 100 - 48, c^2 = 52$$

$$c = \sqrt{52}, c \approx 7.21$$

Distance between the two points = 7.21 m

10 (a) Area of trapezium: $A = 3x^2 - 6x + 9$

Parallel sides: $a = x + 4, b = x - 2$

Using: $A = \frac{1}{2}(a + b)h$

$$3x^2 + 76x + 4 = \frac{1}{2}[(x + 4) + (x - 2)]h$$

$$3x^2 + 76x + 4 = \frac{1}{2}(2x + 2)h$$

$$3x^2 + 76x + 4 = (x + 1)h$$

Factorising:

$$3x^2 + 76x + 4 = (x + 1)(3x + 4)$$

$$\text{Therefore, } h = \frac{(x+1)(3x+4)}{x+1} = 3x + 4$$

Given that, $h = 10$:

$$3x + 4 = 10$$

$$3x = 10 - 4$$

$$3x = 6$$

$$x = 2$$

10 (b) Let the numbers be x and y .

Difference: $x - y = 5$

Product: $xy = 36$

Substitute: $x = y + 5$

$$(y + 5)y = 36$$

$$y^2 + 5y - 36 = 0$$

Factorise: $(y + 9)(y - 4) = 0$

Therefore: $y = 4$ or $y = -9$

$$\text{If } y = 4, x = 9$$

$$\text{If } y = -9, x = -4 \text{ (But numbers must be +ve)}$$

The numbers are: **9 and 4**

11 (a) The Frequency Distribution Table

Class Interval	Frequency (f)	Class Mark (x)	deviation Mean (d)	fd	c.f	Lower Boundary
32 - 39	4	35.5	-16	-64	4	31.5
40 - 47	13	43.5	-8	-104	17	38.5
48 - 55	8	51.5	0	0	25	46.5
56 - 63	6	59.5	8	48	31	54.5
64 - 71	6	67.5	16	96	37	62.5
72 - 79	2	75.5	24	48	39	70.5
80 - 87	0	83.5	32	0	39	78.5
88 - 95	1	91.5	40	40	40	86.5
	$\Sigma f = 40$			$\Sigma fd = 64$		

11 (b) The actual mean

Actual mean = Assumed Mean (A) + $\frac{\Sigma fd}{\Sigma f}$

Where, A = 51.5 (From median Class: 48 - 55)

$$\text{Mean} = 51.5 + \frac{64}{40}$$

$$= 51.5 + 1.6 = 53.1$$

Actual mean = 53.1

$$(c) \text{ Median} = l + \left(\frac{\frac{\Sigma f}{2} - n_b}{n_w} \right) i$$

$$= 46.5 + \left(\frac{\frac{40}{2} - 17}{8} \right) 8$$

$$= 46.5 + \frac{20 - 17}{8} \times 8$$

$$= 46.5 + 3 = 49.5$$

Median = 49.5

The difference is $53.1 - 49.5 = 3.6$

12(a) The angles formed between line AG and the planes ABCD and BCFG

The angle between a line and a plane is the angle between the line and its projection on that plane.

Projection of AG on plane ABCD is AC.

Therefore, the angle formed is $\angle GAC$.

Projection of AG on plane BCFG is BG.

Therefore, the angle formed is $\angle AGB$.

12(a) Answers:

(i) With plane ABCD $\rightarrow \angle GAC$

(ii) With plane BCFG $\rightarrow \angle AGB$

12(b) Given:

Length = 8 cm

Width = 6 cm

Height = 5 cm

(i) Length of AC

In rectangle ABCD: $AC = \sqrt{AB^2 + BC^2}$

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

$$AC = \sqrt{64 + 36}$$

$$AC = \sqrt{100}$$

Length of AC = 10 cm

(ii) Length of AF

AF is the space diagonal of the cuboid.

$$AF = \sqrt{AB^2 + BC^2 + BF^2}$$

$$AF = \sqrt{8^2 + 6^2 + 5^2}$$

$$AF = \sqrt{64 + 36 + 25}$$

$$AF = \sqrt{125}$$

$$AF = 5\sqrt{5} \text{ cm}$$

Length of AF $\approx$ 11.18 cm

(iii) Size of angle CAF

Consider triangle ACF.

Since CF is vertical and AC lies on the base,

$$\angle ACF = 90^\circ$$

In right triangle ACF:

$$\tan(\angle CAF) = \frac{CF}{AC}$$

$$\tan(\angle CAF) = \frac{5}{10}$$

$$\tan(\angle CAF) = 0.5$$

$$\angle CAF = \tan^{-1}(0.5)$$

Size of angle CAF $\approx 26.6^\circ$

12(c) Given: A(10° S, 30° W)

B(11° N, 30° W)

Speed = 900 km/h

Radius of Earth $R = 6400$ km

Since both points lie on the same longitude (30° W), the angular separation is:

$$10^\circ + 11^\circ = 21^\circ$$

Distance along the meridian:

$$s = \frac{21}{360} \times 2\pi R$$

$$s = \frac{21}{360} \times 2\pi(6400)$$

$$s \approx 2345.7 \text{ km}$$

Time taken:

$$t = \frac{2345.7}{900}$$

$$t \approx 2.61 \text{ h}$$

$$0.61 \times 60 \approx 36.4 \text{ min}$$

$$t \approx 2 \text{ h } 36 \text{ min}$$

Departure time = 10:00 am

Arrival time: 10:00 + 2 h 36 min = 12:36 pm

13 (a) Matrix equation

$$\begin{pmatrix} 5 & -2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 9 \end{pmatrix}$$

$$13 \text{ (a) Let } A = \begin{pmatrix} 5 & -2 \\ 3 & 1 \end{pmatrix}$$

$$|A| = (5 \times 1) - (3 \times -2) = 11$$

$$A^{-1} = \frac{1}{11} \begin{pmatrix} 1 & 2 \\ -3 & 5 \end{pmatrix}$$

$$\text{Multiplying } \begin{pmatrix} 5 & -2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 9 \end{pmatrix} \text{ by } A^{-1}$$

$$A^{-1}A \begin{pmatrix} x \\ y \end{pmatrix} = A^{-1} \begin{pmatrix} 4 \\ 9 \end{pmatrix}$$

$$\frac{1}{11} \begin{pmatrix} 1 & 2 \\ -3 & 5 \end{pmatrix} \begin{pmatrix} 5 & -2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11} \begin{pmatrix} 1 & 2 \\ -3 & 5 \end{pmatrix} \begin{pmatrix} 4 \\ 9 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11} \begin{pmatrix} 1(4) + 2(9) \\ -3(4) + 5(9) \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11} \begin{pmatrix} 4 + 18 \\ 45 - 12 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11} \begin{pmatrix} 22 \\ 33 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

$$(x, y) = (2, 3)$$

(b) The matrix, $T = \begin{pmatrix} 2 & 0 \\ 1 & 1 \end{pmatrix}$ shows that the image of point (x, y) is $(2x, x + y)$

Therefore:

$$A' = (2 \times 2, 2 + 1) = (4, 3)$$

$$B' = (2 \times 0, 0 + 3) = (0, 3)$$

$$C' = (2 \times 4, 4 + 2) = (8, 6)$$

Therefore, Triangle $A'B'C'$ has vertices $A'(4, 3)$, $B'(0, 3)$ and $C'(8, 6)$

(c) Matrix rotation for this case:

$$\begin{pmatrix} \cos 180^\circ & -\sin 180^\circ \\ \sin 180^\circ & \cos 180^\circ \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$$

Under this matrix, (x', y') is $(-x, -y)$

The image of $(2, -3) = (-2, 3)$

14(a) Given: $f(x) = \frac{2}{x+1}$

(i) Domain and Range

Domain: The denominator must not be zero.

$$x + 1 \neq 0$$

$$x \neq -1$$

Therefore, Domain = $\{x \in \mathbb{R}: x \neq -1\}$

Range

Since the numerator is 2, the function can never be zero.

$$\frac{2}{x+1} \neq 0, \text{ Thus, } y \neq 0$$

Therefore, Range = $\{y \in \mathbb{R}: y \neq 0\}$

(ii) Find $f^{-1}\left(\frac{1}{2}\right)$

Let $y = \frac{2}{x+1}$

Interchange x and y : $x = \frac{2}{y+1}$

Solve for y :

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

$$xy + x = 2$$

$$xy = 2 - x$$

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

Hence, $f^{-1}(x) = \frac{2-x}{x}$

Now substitute $x = \frac{1}{2}$:

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

$$= \frac{\frac{3}{2}}{\frac{1}{2}} = 3$$

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

14 (b) Let x = number of pens

Let y = number of exercise books

Constraints:

Budget: $3000x + 5000y \leq 45000$

$$3x + 5y \leq 45$$

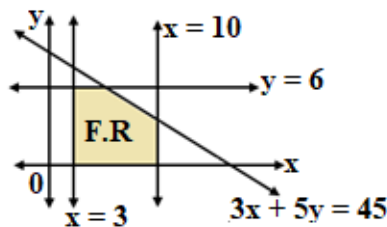
Storage: $y \leq 6$,

Maximum pens: $x \leq 10$

Minimum exercise books: $y \geq 3$

Non-negativity: $x \geq 0, y \geq 0$

Graph for the inequalities



Conner points:

$A(3,0), B(3,6), C(5,6), D(10,3)$

Objective function: $f(x, y) = x + y$

Table of values

$f(x,y)$	$x + y$	Value
$A(3,0)$	$3 + 0$	3
$B(3,6)$	$3 + 6$	9
$C(5,6)$	$5 + 6$	11
$D(10,3)$	$10 + 3$	13

The table shows that the optimal point is $(10,3)$

$x = 10, y = 3$

Maximum number of items:

$T = 10 + 3 = 13$

Answer

- Pens =10
- Exercise books =3
- Maximum total items =13