

ADDITION MATHEMATICS 02

CSSC NZ: FORM FOUR 2026

MARKING GUIDE

SECTION A (60 MARKS)

1 (a)

Given

$$T \propto \sqrt{x} \propto \frac{1}{y^2} \quad \text{00 1/2 mark}$$

$$T \propto \frac{\sqrt{x}}{y^2}$$

introduce constant value.

$$T = K \frac{\sqrt{x}}{y^2} \quad \text{00 1/2 mark}$$

But $T = 6$, $x = 9$ and $y = 8$
From

$$T = K \frac{\sqrt{x}}{y^2}$$

$$6 = K \frac{\sqrt{9}}{8^2}$$

$$6 = K \frac{3}{64}$$

$$K = 128 \quad \text{00 1/2 marks}$$

(i) The equation of a variation.

$$\therefore T = \frac{128 \sqrt{x}}{y} \quad \text{00 1/2 mark}$$

1(a) (ii) when

$$x = \frac{1}{4}, \quad y = \frac{1}{6}$$

From

$$T = \frac{k \sqrt{x}}{y^2}$$

But $k = 128$

001 marks

$$T = \frac{128 \sqrt{\frac{1}{4}}}{\left(\frac{1}{6}\right)^2}$$

$$T = \frac{128 \left(\frac{1}{2}\right)}{\frac{1}{36}} = \frac{64}{\frac{1}{36}}$$

$$T = \frac{64}{\frac{1}{36}}, \quad 64 \times \frac{36}{1}$$

∴ $T = 2304$ 002 marks

(b)

Given that

$$y \propto \frac{1}{x^2} \quad 001 \text{ marks}$$

$$y = k \times \frac{1}{x^2}$$

$$y = \frac{k}{x^2} \quad 002 \text{ marks}$$

But $y = 4$, and $x = 3$

$$k = y \times x^2$$

$$k = 4 \times (3)^2$$

$$k = 4 \times 9$$

002 marks

1(b)

$K = 36$ *001 marks*
 when $x = 6$, $y = ?$

From $K = yx^2$ *001 marks*

$36 = y(6)^2$

$36 = y36$

$$\frac{36}{36} = \frac{36y}{36}$$

$y = 1$

$\therefore$ When $x = 6$ then the value of $y = 1$ *001 marks*

2

Frequency distribution table.

Class Interval	Class mark (x)	Frequency (f)	$d = x - A$	fd
15-20	17.5	10	-12	-120
21-26	23.5	22	-6	-132
27-32	29.5	32	0	0
33-38	35.5	21	6	126
39-44	41.5	13	12	156
45-50	47.5	8	18	144
	<i>001</i>	$\Sigma f = 100$	<i>001</i>	$\Sigma fd = 66$ <i>001</i>

(c) mean by Assumed where Assumed mean is 29.5

$$\text{mean}(\bar{x}) = A + \frac{\Sigma fd}{\Sigma f}$$
 001

$$= 29.5 + \frac{66}{100}$$

$$= 29.5 + 0.66$$

$\therefore$ mean $= 30.16$ *001*

2 (a) mode

$$\text{mode} = L + \left(\frac{t_1}{t_1 + t_2} \right)^c \quad \text{sol}$$

$$L = 27 - 0.5$$

$$L = 26.5$$

$$t_1 = 32 - 22$$

$$t_1 = 10$$

$$t_2 = 32 - 21$$

$$t_2 = 11$$

$$c = 6$$

$$\text{mode} = 26.5 + \left(\frac{10}{10 + 11} \right) 6$$

$$\therefore \text{mode} = 29.36 \quad \text{sol marks}$$

b

From

$$Q_1 = \frac{N}{4} = 25$$

$$Q_3 = \frac{3}{4} N = 75 \quad \text{sol marks}$$

By using interpolation way

$$Q_1 \approx 24.3$$

$$Q_3 \approx 35.1 \quad \text{sol marks}$$

From

$$\text{Semi-interquartile range} = \frac{\text{Highest} - \text{lowest}}{2}$$

$$= \frac{35.1 - 24.3}{2} = 5.4$$

$\therefore$ The ^{semi} interquartile range is 5.4 ~~sol~~ marks

3 (a) Given that point $P(2,4)$, $Q(3,y)$ and $R(-3,4)$ are collinear.

From

$$\text{slope}(PQ) = \text{slope}(PR)$$

$$\text{slope}(PQ) = \frac{\Delta y}{\Delta x}$$

$$\text{slope}(PQ) = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\text{slope}(PQ) = \frac{4 - 4}{-3 - 2}$$

$$\text{slope}(PQ) = \frac{0}{-5} = 0$$

$$\text{slope}(PR) = \text{slope}(PQ)$$

$$\text{slope}(PR) = \frac{\Delta y}{\Delta x}$$

$$\text{slope}(PR) = \frac{y_2 - y_1}{x_2 - x_1}$$

$$0 = \frac{y - 4}{3 - 2}$$

$$0(3 - 2) = 1(y - 4)$$

$$0 = y - 4$$

$$y = 4$$

$\therefore$ The value of $y = 4$

3(b)

points

A(2,3) and B(4,6)

ratio 1:3

(i) Internally.

From internal division

$$(x, y) = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right) \quad \text{or } \frac{1}{2} \text{ marks}$$

$$= \left(\frac{1(4) + 3(2)}{1+3}, \frac{1(6) + 3(3)}{1+3} \right)$$

$$= \left(\frac{10}{4}, \frac{15}{4} \right) \text{ or } \left(\frac{5}{2}, \frac{15}{4} \right)$$

$\therefore$ The coordinate of points divide the line internal is $(x, y) = \left(\frac{10}{4}, \frac{15}{4} \right)$ or $\left(\frac{5}{2}, \frac{15}{4} \right)$ or 1 mark

(ii) Externally

$$(x, y) = \left(\frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n} \right)$$

$$= \frac{1(4) - 3(2)}{1-3}, \frac{1(6) - 3(3)}{1-3}$$

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

$\therefore$ The coordinate of points divide the line external is $(x, y) = \left(1, \frac{3}{2} \right)$ or 1 mark

4 (a) LOCUS is a path traced by a moving satisfying given conditions. 0.2 marks

(b) Given points A and B are $(-3, 0)$ and $(3, 0)$ respectively.

$$\text{If } AP = 2PB$$

From

Distance formula =

$$AP = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad \text{0.2 marks}$$

$$\overrightarrow{AP} = (-3, 0) \text{ and } P(x, y)$$

$$AP = \sqrt{(x+3)^2 + (y-0)^2}$$

$$\text{For } PB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad \text{0.2 marks}$$

But
 $P(x, y)$ and $B(3, 0)$

$$PB = \sqrt{(3-x)^2 + (0-y)^2}$$

$$PB = \sqrt{(3-x)^2 + (y)^2}$$

$$AP = 2PB$$

$$\sqrt{(x+3)^2 + y^2} = 2\sqrt{(3-x)^2 + y^2} \quad \text{0.2 marks}$$

P.T.O

$$4(b) \left(\sqrt{(x+3)^2 + y^2} \right)^2 = \left(2 \sqrt{(3-x)^2 + y^2} \right)^2 \quad \text{0.5 marks}$$

$$(x+3)^2 + y^2 = 4(3-x)^2 + y^2 \quad \text{0.5 marks}$$

$$x^2 + 6x + 9 + y^2 = 4(x^2 - 6x + 9 + y^2)$$

$$x^2 + 6x + 9 + y^2 = 4x^2 - 24x + 36 + 4y^2 \quad \text{0.5 marks}$$

$$3x^2 + 3y^2 - 30x + 27 = 0$$

divide by 3 both side

$$x^2 + y^2 - 10x + 9 = 0 \quad \text{shown} \quad \text{0.5 marks}$$

5 (a)

Given

$$4x^2 - 4xy - 3y^2$$

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

(b)

Given

$$x^2 + y^2 = 18$$

$$y - 2x = -3$$

} by substitution method

$$x^2 + y^2 = 18 \quad \dots (1)$$

$$y - 2x = -3 \quad \dots (ii)$$

Take eqn (ii)

$$y - 2x = -3$$

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

Substitute eqn (iii) into eqn (i)

$$x^2 + (-3 + 2x)^2 = 18 \quad \text{0.2 marks}$$

5 (b) $x^2 + 4x^2 - 12x + 9 = 18$

$$5x^2 - 12x - 9 = 0$$

Solve by using general formula.

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

$$x = 3 \text{ or } x = -\frac{3}{5} \quad 0 \text{ marks}$$

For y

$$y = -3 + 2x$$

$$y = -3 + 2 \times 3$$

$$y = -3 + 6$$

$$y = 3 \quad 0 \text{ marks}$$

or

$$\text{when } x = -\frac{3}{5}$$

$$y = -3 + 2x$$

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

$$y = -3 + \left(-\frac{6}{5}\right)$$

$$y = -3 - \frac{6}{5}$$

$$y = -\frac{21}{5}$$

$$\therefore x = 3 \text{ and } y = 3 \text{ or } x = -\frac{3}{5} \text{ and } y = -\frac{21}{5} \quad 0 \text{ marks}$$

6

Given

$$\text{interior angle} = x.$$

$$\text{Exterior angle} = \frac{x-36}{3}$$

(a) The value of x .

Since supplementary angle
 (interior + exterior) angle = 180° 0 / marks

$$x + \frac{x-36}{3} = 180$$

$$3x + x - 36 = 540 \quad 0 /$$

$$4x - 36 = 540$$

$$4x = 540 + 36$$

$$\frac{4x}{4} = \frac{504}{4} \quad \frac{576}{4}$$

$$x = 144^\circ \quad 0 / \text{ marks}$$

$\therefore$ The value of x is ~~1440~~ 144°

(b) Size of each interior angle.

interior angle is the value of x

$$\text{hence } x = 144^\circ$$

$\therefore$ The size of interior angle

$$\text{external angle} = 180^\circ - 144 = 36^\circ$$

$$E = \frac{36^\circ}{n} = 36^\circ = \frac{360^\circ}{n} \quad 0 /$$

6 (b)

$$n = 10$$

From n is ~~numb~~ number of ^{sides} polygon.

$$\text{internal} = \left(\frac{n-2}{n} \right) 180^\circ \quad \text{or}$$

$$= \left(\frac{10-2}{10} \right) 180^\circ$$

$$= \left(\frac{0.8}{1} \right) 180^\circ$$

$$= 144^\circ \quad \text{or}$$

$\therefore$ The size of each interior angle is 144°

7 @

Given

$$x = a \tan \phi \text{ and } y = b \cos \phi$$

By eliminate ϕ

$$\tan \phi = \frac{x}{a} \quad 0 \text{ / marks}$$

$$\cos \phi = \frac{y}{b}$$

From

$$1 + \tan^2 \phi = \sec^2 \phi$$

$$\cos^2 \phi = \frac{1}{1 + \tan^2 \phi} \quad 0 \text{ / mark}$$

$$\frac{y^2}{b^2} = \frac{1}{1 + \frac{x^2}{a^2}}$$

$$\underline{a^2 y^2 + b^2 x^2 = a^2 b^2} \quad 0 \text{ / mark}$$

(b)

Given

$$3 \cot^2 x = 2 \cos x \quad \text{where } -90^\circ \leq x \leq 360^\circ$$

$$\cot^2 x = \frac{\cos 2x}{\sin 2x} \quad 0 \text{ / marks}$$

(according to angle formulae.)

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

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

$$x = \cos^{-1}\left(\frac{1}{2}\right) \quad 0 \text{ / marks}$$

$$x = 60^\circ \quad \text{First quadrant.}$$

7(b) $\angle c = 360 - \phi$ in fourth quadrant.

$$\angle c = 360^\circ - 60^\circ$$

$$\angle c = 300^\circ$$

$$\angle c = 60^\circ, 90^\circ, 270^\circ, 300^\circ \quad 0/1 \text{ marks}$$

8 @ Seventh terms in pascal triangle.
pascal triangle.

1st							
			1				
2nd			1		1		
				1		2	
3rd			1		2		1
				1		3	
4th			1		3		3
				1		6	
5th			1		4		6
				1		10	
6th			1		5		10
				1		15	
7th			1		6		15
				1		20	
					1	15	
						6	
							1

0/1 marks

The Sum = $1 + 6 + 15 + 20 + 15 + 6 + 1$ 0/1 marks

$$\text{Sum of } (7^{\text{th}}) = 64 \quad 0/1 \text{ marks}$$

(b)

The number 658625

$$\text{Sum of odd position} = 6 + 8 + 2 = 16$$

$$\text{Sum of even position} = 5 + 6 + 5 = 16$$

$$16 - 16 = 0 \quad \text{The difference is multiple of 11}$$

$\therefore$ 658625 is divisible by 11 (0/3 marks)

9 (a)

Given

$$[(\neg P \vee \neg Q) \rightarrow \neg(P \wedge Q)] \vee [(P \vee Q) \rightarrow (\neg P \wedge \neg Q)]$$

P	Q	$\neg P$	$\neg Q$	$\neg P \vee \neg Q$	$P \wedge Q$	$\neg(P \wedge Q)$	$A \rightarrow B$	D	$(P \vee Q)$	$(\neg P \wedge \neg Q)$	$D \rightarrow E$	$C \vee (D \rightarrow E)$
T	T	F	F	F	T	F	T	T	F	F	F	T
T	F	F	T	T	F	T	T	T	F	F	F	T
F	T	T	F	T	F	T	T	T	F	F	F	T
F	F	T	T	T	F	T	T	F	T	T	T	T

04 marks

B

$$P \wedge Q = P \leftrightarrow Q$$

$$\text{But } P \leftrightarrow Q = (P \rightarrow Q) \wedge (Q \rightarrow P)$$

$$P \leftrightarrow Q = T$$

when $P = T$ and $Q = T$

$$\text{But } P \wedge Q = T \wedge T = T$$

whenever $P \wedge Q$ is true, $P \leftrightarrow Q$ is also true.

∴ $P \wedge Q$, logically implies $P \leftrightarrow Q$, hence shown

02 marks

10

Given.

Let A to be number of students taking Business.
 B to be number of students taking Mathematics.
 C to be number of students taking Economics.

$$n(A) = 329$$

$$n(B) = 186$$

$$n(C) = 295$$

$$n(A \cap B) = 83$$

$$n(B \cap C) = 63$$

$$n(A \cap C) = 217$$

02 marks

$$n(A \cup B \cup C) = 500$$

$$n(A \cap B \cap C) = ?$$

From

$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$$

$$500 = 329 + 186 + 295 - 83 - 63 - 217 + x$$

$$500 = 810 - 363 + x$$

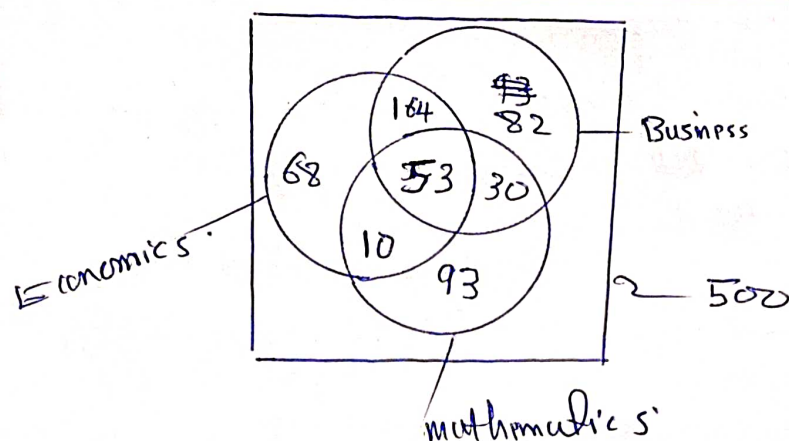
$$500 = 447 + x$$

$$x = 500 - 447$$

$$x = 53$$

Venn diagram.

10



04 marks

SECTION B (MARKS 60)

11 (a)

Given

$$3^{2x} - 3^x - 6 = 0$$

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

$$\text{Let } y = 3^x \quad \text{02 marks}$$

$$y^2 - y - 6 = 0$$

solve for y.

$$y = -2 \text{ or } y = 3$$

and

$$3^{2x} = 3^1 \quad \left\{ \begin{array}{l} \text{The same} \\ \text{-exponent} \end{array} \right. \text{ equate } y$$

$$2x = 1$$

02 marks

11 (b)

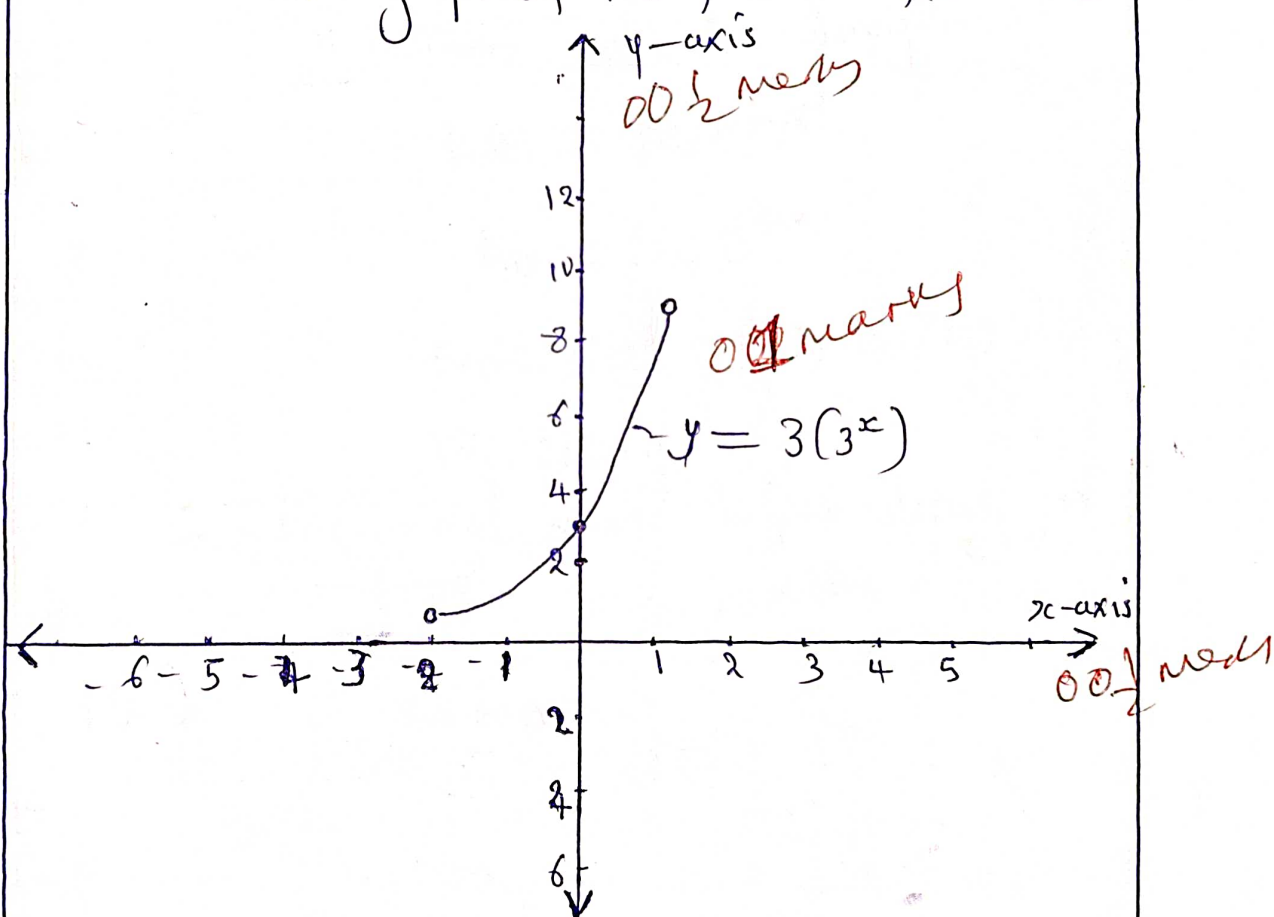
Given:

$$f(x) = 3(3^x) \text{ for } -2 < x < 1$$

Table value.

x	-2	-1	0	1
$f(x) = 3(3^x)$	$\frac{1}{3}$	1	3	9

The graph of the function $f(x) = 3(3^x)$



Domain $f(x) = \{x: -2 < x < 1\}$ 0/1 marks

Range $f(x) = \{y: \frac{1}{3} < y < 9\}$ 0/1 mark

11 c

Given:

$$T = 2.8 \text{ day}$$

$$t = 2 \text{ weeks} = 14 \text{ days}$$

$$\text{mass after 14 days } (N_{14}) = 5 \text{ g.}$$

From

$$K = \frac{\ln 2}{2.8}$$

$$K = 0.247552564$$

0/1 marks

From radioactive decay.

$$N(t) = N_0 e^{-Kt}$$

$$N_0 = N_{14} e^{14K}$$

$$N_0 = 5 e^{0.247552564(14)}$$

$$N_0 = 160 \text{ g}$$

$\therefore$ The initial mass before decay is 160g. 0/2 marks

12 @

Given:

12@

Given

$$\frac{dy}{dx} \text{ for } 3x^2 - 7y^2 + 4xy - 8x = 0$$

at point $(-1, 1)$

$$6x dx - 14y dy + 4x dy + 4y dx - 8 dx = 0$$

divide by dx both term.

$$6x \frac{dx}{dx} - 14y \frac{dy}{dx} + 4x \frac{dy}{dx} + 4y \frac{dx}{dx} - 8 \frac{dx}{dx}$$

$$6x - 14y \frac{dy}{dx} + 4x \frac{dy}{dx} + 4y - 8 = 0$$

$$(-14y + 4x) \frac{dy}{dx} = 8 - 6x - 4y$$

Divide by $-14y + 4x$ both side

$$\frac{(-14y + 4x) \frac{dy}{dx}}{-14y + 4x} = \frac{8 - 6x - 4y}{-14y + 4x}$$

$$\frac{dy}{dx} = \frac{8 - 6x - 4y}{-14y + 4x} \quad 0/1 \text{ mark}$$

At point $(-1, 1)$

$$\frac{dy}{dx} (-1, 1) = \frac{8 - (6 \times -1) - (4 \times 1)}{-(14 \times 1) + (4 \times -1)}$$

$$= \frac{10}{-18} = \frac{5}{-9}$$

$$\therefore \frac{dy}{dx} \text{ at point } (-1, 1) = -\frac{5}{9} \quad 0/1 \text{ mark}$$

12 (b)

Given that

$$s(t) = 50t - 5t^2 \text{ in metres.}$$

$$(i) \text{ velocity } v(t) = \frac{d}{dt} s(t)$$

$$= \frac{d}{dt} (50t - 5t^2)$$

$$= 50 - 10t \quad 01 \text{ mark}$$

after 3 sec -

$$= (50 - (10 \times 3))$$

$$= (50 - 30)$$

$$= 20 \text{ m/s}$$

$\therefore$ The velocity is 20 m/s 02 marks

(ii)

$$a(t) = \frac{d}{dt} (v(t))$$

$$\frac{d}{dt} a(t) = \frac{d}{dt} (50 - 10t)$$

$$= \frac{d}{dt} (-10)$$

$$= -10 \text{ m/s}^2$$

$\therefore$ acceleration is -10 m/s^2 . 02 marks

12 c

$$\int (3x+2)^5 dx$$

Let $u = 3x+2$.

$$\frac{du}{dx} = 3.$$

$$\frac{du}{dx} \neq 3$$

$$3dx = du$$

$$dx = \frac{du}{3}$$

$$\frac{3dx}{dx} = \frac{du}{dx}$$

$$\int (3x+2)^5 dx = \int u^5 \frac{du}{3} \quad 0/1 \text{ mark}$$

$$\int u^5 \times du \times \frac{1}{3} = \frac{1}{3} \int u^5 du$$

$$\frac{1}{3} \int u^5 du = \frac{1}{3} \left(\frac{u^{5+1}}{5+1} \right) + C.$$

$$= \frac{1}{3} \left(\frac{u^6}{6} \right) + C.$$

$$= \frac{1}{3} \left(\frac{(3x+2)^6}{6} \right) + C. \quad \text{But } u=3x+2.$$

$$= \frac{(3x+2)^6}{18} + C.$$

$$\therefore \int (3x+2)^5 dx = \frac{(3x+2)^6}{18} + C. \quad 02 \text{ marks}$$

13 @

Given the letters MWAMBANA.

Four "A" a like letter $p=4$

Two "W" a like letter $q=2$.

Two "M" a like letter $s=2$

Total letter $n=10$

00 1/2 marks

$$\text{Permutation } P = \frac{n!}{p! q! s!} = \frac{10!}{4! 2! 2!}$$

$$P = \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{4 \times 3 \times 2 \times 1 \times 2 \times 1 \times 2 \times 1}$$

$$P = 37,800 \text{ ways.}$$

02 marks

∴ There are 37,800 ways.

(b)

Given $n=10$ and $r=4$

From combination formula.

$${}^nC_r = \frac{n!}{(n-r)! r!}$$

$$= \frac{10!}{(10-4)! 4!}$$

$$= \frac{10!}{6! 4!}$$

$$= \frac{10 \times 9 \times 8 \times 7 \times 6!}{6! 4!}$$

02 marks

$$= \frac{10 \times 9 \times 8 \times 7}{4!} = \frac{10 \times 9 \times 8 \times 7}{4 \times 3 \times 2 \times 1}$$

$$= \frac{5040}{24}$$

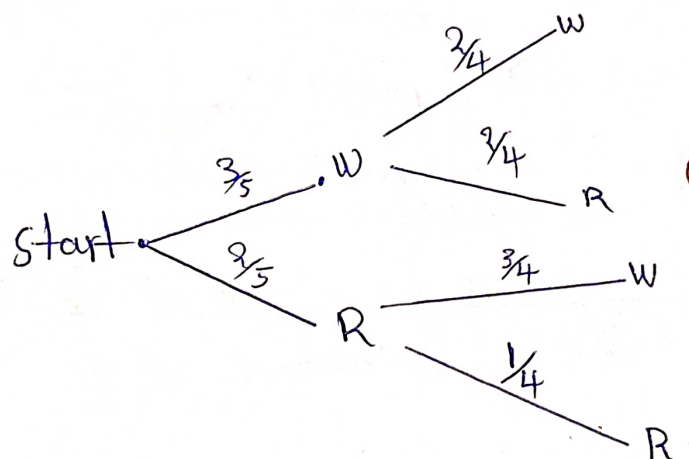
∴ There are 210 ways.

13 c

consider the diagram

let W represent white ball

R represent red ball



01 marks

$$\begin{aligned}
 (i) \quad P(RR) &= \frac{2}{5} \times \frac{1}{4} \\
 &= \frac{2}{5} \times \frac{1}{4} = \frac{2}{20} \\
 &= \frac{1}{10}
 \end{aligned}$$

02 marks

$\therefore$ The probability of both red is $\frac{1}{10}$

(ii) Balls are different colours

$$\begin{aligned}
 P &= P(WR) + P(RW) \\
 &= \left(\frac{2}{5} \times \frac{3}{4}\right) + \left(\frac{2}{5} \times \frac{3}{4}\right) \\
 &= \frac{2}{10} + \frac{3}{10} \\
 &= \frac{5}{10} = \frac{1}{2}
 \end{aligned}$$

00 1/2 marks

02 marks

$\therefore$ The probability of both are different is $\frac{1}{2}$

14(a) consider table showing the types of Curtains.

	TYPE OF CURTAINS		
	ORDINARY	DELUXE	TOTAL
TIME	1.5 hour	3 hours	30 hours
MATERIAL	12 metres	14 metres	180 metres
PROFIT	18,500/-	25,500/-	

let x be number of ordinary Curtains. 01 mark
 y be number of deluxe Curtains.

1st step: Constraints

(i) $1.5x + 3y \leq 30$ --- (i) 02 marks
 $12x + 14y \leq 180$ --- (ii)
 $x \geq 0, y \geq 0$ --- (iii)

Objective function $f(x) = 18500x + 25500y$.

(ii) For maximize the profit.

1st formulate table value for each.

$$1.5x + 3y = 30$$

Table value.

x	0	20
y	10	0

14(a) (ii) Table value of $12x + 14y = 30$

x	0	15
y	12.8	0

Graph.

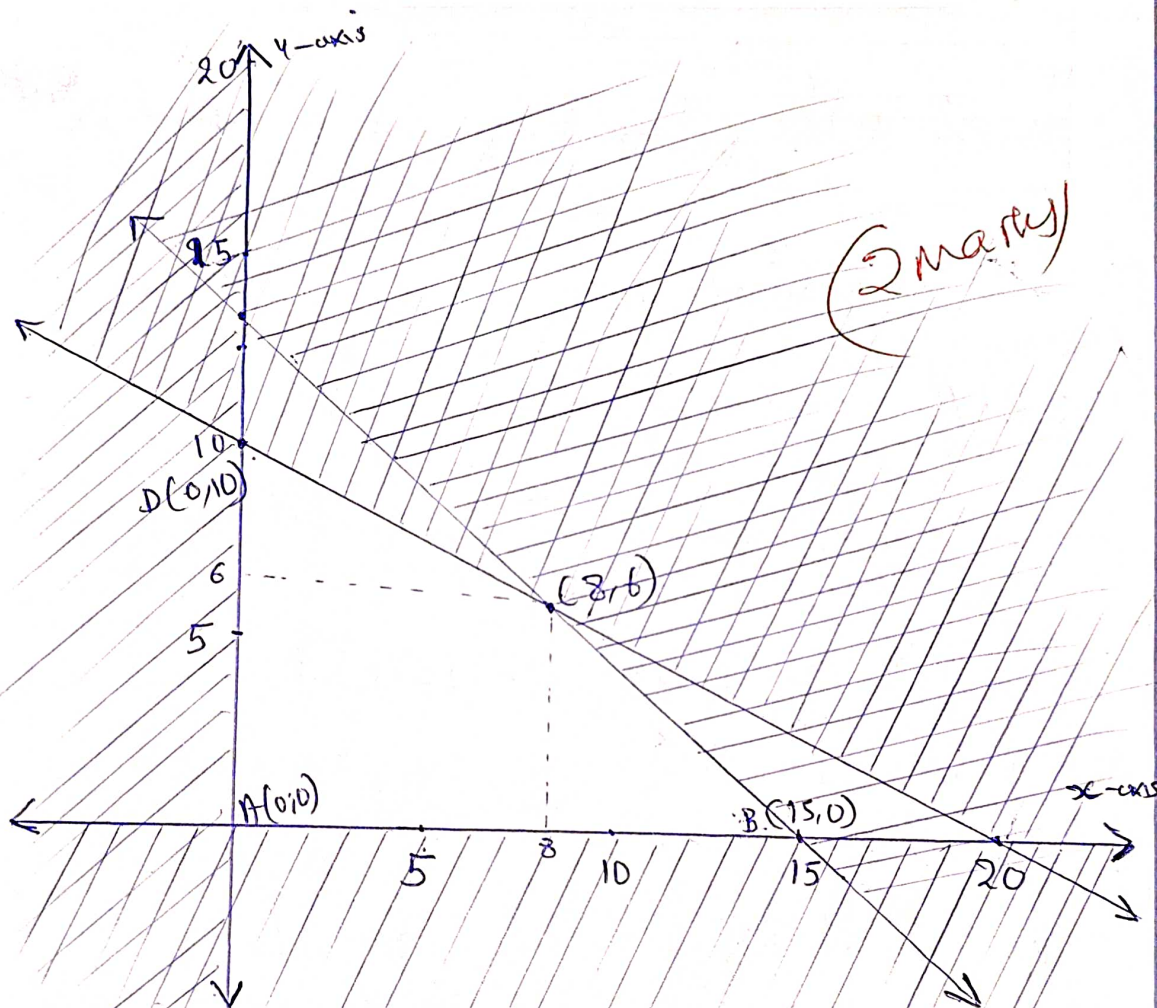


Table shown the corner points.

Corner points	Objective function $f(x) = 18,500x + 25,500y$	Total
A(0,0)	$(18,500 \times 0) + (25,500 \times 0)$	0
B(15,0)	$(18,500 \times 15) + (25,500 \times 0)$	$277,500 =$
C(8,6)	$(18,500 \times 8) + (25,500 \times 6)$	$301,100 =$
D(0,10)	$(18,500 \times 0) + (25,500 \times 10)$	$255,000 =$

14 @

$\therefore$ 8 units of ordinary and 6 units of deluxe should maximize profit of 30,000/=

01 marks

(b) Required to find value of a

from $K = \begin{pmatrix} a & 2a & 0 \\ 0 & a & 1 \\ -1 & -1 & a \end{pmatrix}$, But $|K| = 0$.

01 mark

$$|K| = a \begin{vmatrix} a & 1 \\ -1 & a \end{vmatrix} - 2a \begin{vmatrix} 0 & 1 \\ -1 & a \end{vmatrix} + 0 \begin{vmatrix} 0 & a \\ -1 & -1 \end{vmatrix}$$

$$= a(a^2 + 1) - 2a(0 + 1) + 0$$

$$= a^3 + a - 2a$$

$$0 = a^3 - a$$

$$a^3 - a = 0$$

$$a(a^2 - 1) = 0$$

$$a = 0$$

$$a^2 - 1 = 0$$

$$a^2 = 1$$

$$a = \pm 1$$

01 mark

$\therefore$ Values of $a = \underline{0}$ or $a = \underline{-1}$ or $a = \underline{1}$.

0 mark