UCE MATHEMATICS PAPER 2 2017 guide

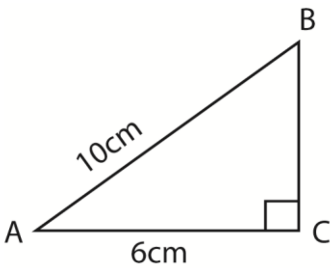
SECTION A (40 marks)

Answer all questions in this section

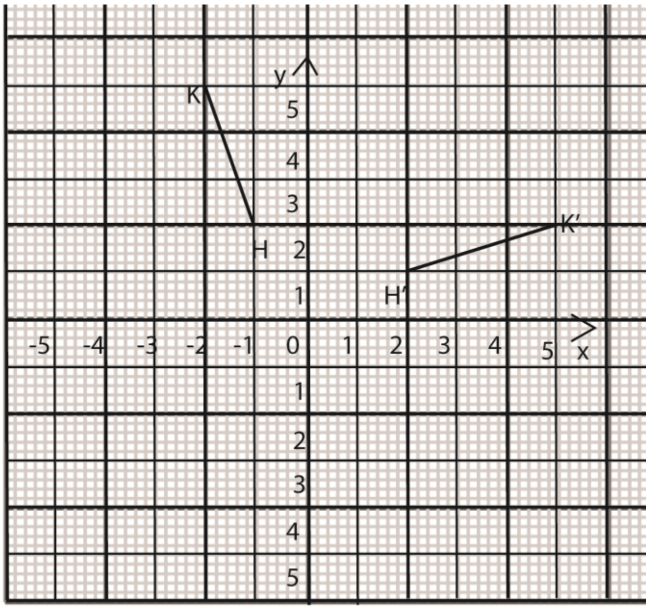
1. Factorize: $(x + 4)^2 – (x - 3)^2$. (04marks)
2. Solve the simultaneous equation
   $2x - 3y = 7$
   $X + 4y = -2$ (04marks)
3. The table below shows marks obtained by 34 students in chemistry test

| Marks | Number of students |
|---|---|
| 20 – 29 | 3 |
| 30 – 39 | 5 |
| 40 – 49 | 8 |
| 50 – 59 | 8 |
| 60 – 69 | 10 |

   Calculate the mean mark. (04marks)
4. Given that $s*t = 2s^2 - 3t$, evaluate $6*(5*2)$. (04marks)
5. An interior angle of a rectangular polygon is $162^0$. Find the sum of its interior angles. (04marks)
6. Fins the value of x and y in $3\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix} - 2\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}$. (04marks)
7. Solve for x in the inequality: $\frac{1}{2} - \frac{2}{3}x < \frac{1}{6}x - \frac{1}{4}$. (04marks)
8. In the right angled triangle ABC, AB = 10 and AC = 6




   Determine the;
   (a) Length of BC. (02marks)
   (b) Area of the triangle ABC. (02marks)
9. A number which s divisible by 3 is chosen at random from a set of even numbers between 1 and 20. What is the probability of choosing the number? (04marks)
10. A graph below shows the line HK and its image H'K' after rotation in the clock wise direction.




Use the graph to determine the;

(a) coordinates of the centre of rotation (02marks)

(b) angle of rotation (02marks)

SECTION B: (60MARKS)

Answer any five questions from this section. all questions carry equal marks.

11. (a) Copy and complete table of values for $y = x^2 + 2x - 15$ (03marks)

| x | -6 | -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $x^2$ | 36 | | | | | | | | | | |
| 2x | -12 | | | | | | | | | | |
| -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 |
| y | 9 | | | | | | | | | | |

(b) Use your completed table to draw the graph $y = x^2 + 2x - 15$.
Use a scale of 1cm to represent 1 unit on the x-axis, 1cm to represent 2 units on the y-axis. (04marks)

(c) Draw on the same graph the line y = 2x – 14.
Hence solve the equation x2 – 1 = 0 (05marks)

12. Four schools participated in a football tournament which was played in two rounds. The results were as given below

1st round

- Bakulu S.S won one, drew three and lost two matches.
- Dodo S.S won two, drew two and lost two matches
- Kawunga S.S won three, drew two and lost one match
- Oronga S.S won none, drew two and lost four matches.

2nd round

- Bakulu S.S won one, drew two and lost three matches.
- Dodo S.S won two, drew one and lost three matches
- Kawunga S.S won two, drew three and lost one match
- Oronga S.S won one, drew four and lost 1 match.

(a) Write down a 4 x 3 matrix which shows the performance of the schools in

(i) each of the two rounds (04marks)

(ii) both rounds (03marks)

(b) Three points are awarded for a win, one point for a draw and no point for a loss.

(i) Write down a 3 x 1 matrix to represent the award of points (01marks)

(ii) Using matrix multiplication, determine which school won the tournament. (04marks)

13. (a) Make d the subject of the expression

L = $\sqrt{\frac{3B}{T-D}}$

Hence, find the value of D when B = 540, L = 18 and T = 17

(b) Auma bought 5 sachets of washing powder and a tube of toothpaste at shs. 1,700 in January

In February she bought 15 sachets of washing power and 2 tubes of toothpaste at shs. 4,400. What is the cost of each item during the two months? (06marks)

14. Using a ruler, a pencil and a pair of compasses only,

(a) Construct a triangle ABC, where ABC = 75$^0$, $\overline{AB} = 9.3cm$, $\overline{BC} = 8.7cm$ (05marks)

(b) Measure the length Ac and angle ACB. (02 marks)

(c) (i) Draw an inscribed circle in the triangle ABC.

(ii) Find the radius of the circle. (05marks)

15. A cupboard has 5 white cups and 3 black cups. Two cups are picked from the cupboard one after the other without replacement.

(a) Draw a tree diagram to represent the given information (05marks)

(b) Calculate the probability of picking

(i) one white cup and one black cup

(ii) two cups of the same colour

(iii) at least one white cup. (07 marks)

16. A triangle whose vertices are P, Q and R is mapped on a triangle whose vertices are P'(0, 1), Q'(5, 7) and R'(0, 2) by matrix of transformation $\begin{pmatrix} 3 & -1 \\ 4 & -1 \end{pmatrix}$. The triangle P'Q'R' is then mapped onto triangle P''Q''R'' by matrix transformation$\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.

Find the;

(a) Coordinates of P'', Q'' and R''. (03marks)

(b) Single matrix transformation which would map P''Q''R'' back onto PQR. (04marks)

(c) Coordinates of P, Q and R. (05marks)

17. An investor wants to buy 2 types of generators A and B. generator a needs 2m2 of space and B needs 3m2. The available space is only 60m2. The cost of a is $2,000 and that of B is $10,000. The investor has $880,000 to spend. If x and y represent number of generators of type A and B respectively.

(a) Write down four inequalities from the information given (04marks)

(b) Represent the four inequalities on the same axes. (06marks)

(c) Find the greatest number of generators of both type A and B that the investor can by using the minimum amount of money. (02marks)

## Solutions

SECTION A (40 marks)

Answer all questions in this section

1. Factorize: $(x + 4)^2 – (x - 3)^2$. (04marks)
   Using difference of square
   $(x + 4)^2 – (x - 3)^2 = \{(x + 4) + (x -3)\} \{(x + 4) - (x -3)\}$
   $= \{x + 4+ x -3\}(x + 4 –x + 3\}$
   $= (2x +1)(7)$ 0r $7(2x +1)$
2. Solve the simultaneous equation
   2x - 3y = 7
   x + 4y = -2 (04marks)
   Method I: elimination
   2x - 3y = 7 ………………… (i)
   x + 4y = -2 ………………… (ii)
   eqn. (i) – 2eqn. (ii)
   -11y = - 11
   y = -1
   Substituting y = -1 in eqn. (i)
   2x -3(-1) = 7
   2x +3 = 7
   x = 2
   Method II: Using substitution method
   2x - 3y = 7 ………………… (i)
   x + 4y = -2 ………………… (ii)
   Making x the subject in eqn. (i)
   2x = 7 + 3y
   $x = \frac{7+3y}{2}$ ………………………..(iii)
   Substituting for x in equation (ii)
   $\frac{7+3y}{2} + 4y = -2$
   $\frac{7+3y+8y}{2} = -2$
   $7 + 11y = -4$
   $11y = -11$
   $y = -1$
   $substituting\ y = -1$ in equation (iii)
   $x = \frac{7+3(-1)}{2} = \frac{4}{2} = 2$
   Method III; using matrix method
   2x - 3y = 7
   x + 4y = -2
   $\begin{pmatrix} 2 & -3 \\ 1 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$
   Pre-multiplying both sides of the equation by inverse matrix
   Determinant = 4 x 2 – 1 x(-3)= 8 + 3 = 11
   Inverse matrix = $\frac{1}{11}\begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix}$

$\frac{1}{11}\begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix}\begin{pmatrix} 2 & -3 \\ 1 & 4 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11}\begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix}\begin{pmatrix} 7 \\ -2 \end{pmatrix}$

$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{11}\begin{pmatrix} 28-6 \\ -7-4 \end{pmatrix}$

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

Hence x = 2, y = -1

3. The table below shows marks obtained by 34 students in chemistry test

| Marks | Number of students |
|---|---|
| 20 – 29 | 3 |
| 30 – 39 | 5 |
| 40 – 49 | 8 |
| 50 – 59 | 8 |
| 60 – 69 | 10 |

Calculate the mean mark. (04marks)

| Marks | x | Number of students (f) | fx |
|---|---|---|---|
| 20 – 29 | 24.5 | 3 | 73.5 |
| 30 – 39 | 34.5 | 5 | 172.5 |
| 40 – 49 | 44.5 | 8 | 356 |
| 50 – 59 | 54.5 | 8 | 436 |
| 60 – 69 | 645 | 10 | 645 |
| | | $\sum f = 34$ | $\sum fx = 1683$ |

Mean = $\frac{\sum fx}{\sum f} = \frac{1683}{34} = 49.5$

4. Given that s*t = $2s^2$ - 3t, evaluate 6*(5*2). (04marks)

5*2 = $2(5)^2$ – 3 x 2 = 50 – 6 = 44

6*(5*2) = 6*44

= $2(6)^2$ – 3 x 44

= 72 – 132

= -60

5. An interior angle of a rectangular polygon is $162^0$. Find the sum of its interior angles. (04marks)

Exterior angle = 180 – 162 = $18^0$

Number of sides = $\frac{360^0}{18^0} = 20$

Sum of interior angles = 180(n-2)

= 180 (20 – 2) =180 x 18 = $3240^0$

6. Fins the value of x and y in $3\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix} - 2\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}$. (04marks)

$3\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix} - 2\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}$.

$3\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} + 2\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} = 3\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}$

$\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}$

By equating corresponding elements

x = 3 and y = 4

7. Solve for x in the inequality: $\frac{1}{2} - \frac{2}{3}x < \frac{1}{6}x - \frac{1}{4}$. (04marks)

$\frac{1}{2} - \frac{2}{3}x < \frac{1}{6}x - \frac{1}{4}$.

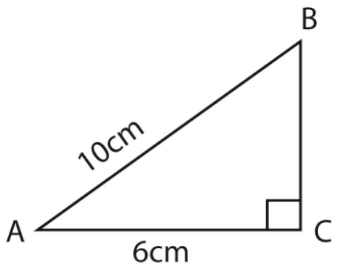
Multiplying through by 12

6 – 8x < 2x – 3

9 < 10x

$\frac{9}{10} < x$ or x > $\frac{9}{10}$

8. In the right angled triangle ABC, AB = 10 and AC = 6




Determine the;

(a) Length of BC. (02marks)

$10^2 = 6^2 + \overline{BC}^2$

$\overline{BC}^2 = 100 - 36 = 64$

$\overline{BC} = \sqrt{64}$ = 8cm

(b) Area of the triangle ABC. (02marks)

Area = $\frac{1}{2}bh = \frac{1}{2}\ x\ 8\ x\ 6 = 24cm^2$

9. A number which s divisible by 3 is chosen at random from a set of even numbers between 1 and 20. What is the probability of choosing the number? (04marks)

Sample space ={2, 4, 6, 8, 10, 12, 14, 16, 18}

n(S) = 9

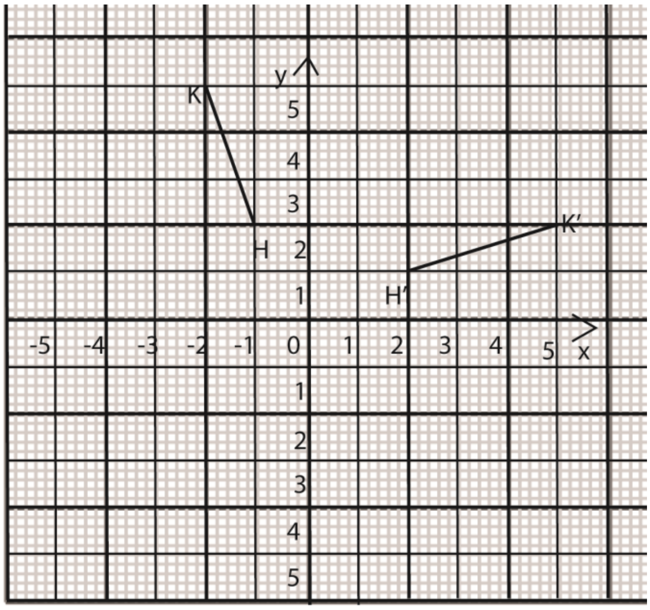
Let A = number divisible by 3

A = {6, 12, 18}

n(A) = 3

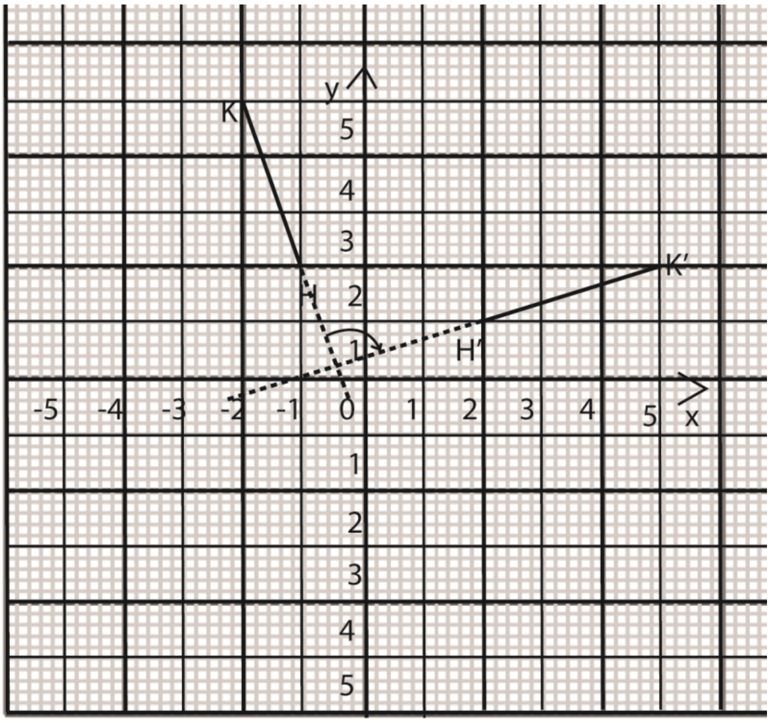
P(A) = $\frac{n(A)}{n(S)} = \frac{3}{9} = \frac{1}{3}$

10. A graph below shows the line HK and its image H'K' after rotation in the clock wise direction.




Use the graph to determine the;

The graph below shows the line HK and its image H'K' after a rotation in the clockwise direction




(a) coordinates of the centre of rotation; (-0.4, 0.2) (02marks)

(b) angle of rotation; $90^0$ (02marks)

SECTION B: (60MARKS)

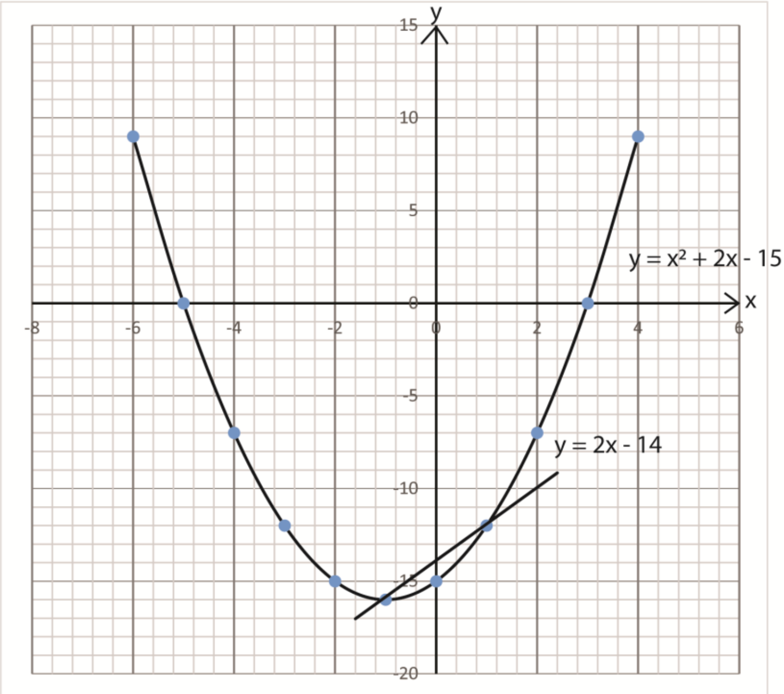
Answer any five questions from this section. all questions carry equal marks.

11. (a) Copy and complete table of values for $y = x^2 + 2x - 15$ (03marks)

| x | -6 | -5 | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $x^2$ | 36 | 25 | 16 | 9 | 4 | 1 | 0 | 1 | 4 | 9 | 16 |
| 2x | -12 | -10 | -8 | -6 | -4 | -2 | 0 | 2 | 4 | 6 | 8 |
| -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 | -15 |
| y | 9 | 0 | -7 | -12 | -15 | -16 | -15 | -12 | -7 | 0 | 9 |

(b) Use your completed table to draw the graph $y = x^2 + 2x - 15$.

Use a scale of 1cm to represent 1 unit on the x-axis, 1cm to represent 2 units on the y-axis. (04marks)




(c) Draw on the same graph the line $y = 2x – 14$.

For $y = 2x – 14$

| x | 0 | 2 |
|---|---|---|
| y | -14 | -10 |

Hence solve the equation x2 – 1 = 0 (05marks)

Solution are got from points of intersection.

Hence x = -14 and x = 1

12. Four schools participated in a football tournament which was played in two rounds. The results were as given below

1st round

- Bakulu S.S won one, drew three and lost two matches.
- Dodo S.S won two, drew two and lost two matches
- Kawunga S.S won three, drew two and lost one match
- Oronga S.S won none, drew two and lost four matches.

2nd round

- Bakulu S.S won one, drew two and lost three matches.
- Dodo S.S won two, drew one and lost three matches
- Kawunga S.S won two, drew three and lost one match

- Oronga S.S won one, drew four and lost 1 match.

(a) Write down a 4 x 3 matrix which shows the performance of the schools in

(iii) each of the two rounds (04marks)

1st round

$$\begin{matrix} Bakulu \\ Dodo \\ Kawunga \\ Orongo \end{matrix} \overset{W\ D\ L}{\begin{pmatrix} 1 & 3 & 2 \\ 2 & 2 & 2 \\ 3 & 2 & 1 \\ 0 & 2 & 4 \end{pmatrix}}$$

2nd round

$$\begin{matrix} Bakulu \\ Dodo \\ Kawunga \\ Orongo \end{matrix} \overset{W\ D\ L}{\begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \\ 2 & 3 & 1 \\ 1 & 4 & 1 \end{pmatrix}}$$

(iv) both rounds (03marks)

$$\begin{pmatrix} 1 & 3 & 2 \\ 2 & 2 & 2 \\ 3 & 2 & 1 \\ 0 & 2 & 4 \end{pmatrix} + \begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \\ 2 & 3 & 1 \\ 1 & 4 & 1 \end{pmatrix} = \begin{pmatrix} 2 & 5 & 5 \\ 4 & 3 & 5 \\ 5 & 5 & 2 \\ 1 & 6 & 5 \end{pmatrix}$$

Hence, $\begin{matrix} Bakulu \\ Dodo \\ Kawunga \\ Orongo \end{matrix} \overset{W\ D\ L}{\begin{pmatrix} 2 & 5 & 5 \\ 4 & 3 & 5 \\ 5 & 5 & 2 \\ 1 & 6 & 5 \end{pmatrix}}$

(b) Three points are awarded for a win, one point for a draw and no point for a loss.

(iii) Write down a 3 x 1 matrix to represent the award of points (01marks)

$$\begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$$

(iv) Using matrix multiplication, determine which school won the tournament. (04marks)

$$\begin{matrix} Bakulu \\ Dodo \\ Kawunga \\ Orongo \end{matrix} \begin{pmatrix} 2 & 5 & 5 \\ 4 & 3 & 5 \\ 5 & 5 & 2 \\ 1 & 6 & 5 \end{pmatrix} \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 6+5+0 \\ 12+3+0 \\ 15+5+0 \\ 3+6+0 \end{pmatrix} = \begin{pmatrix} 11 \\ 15 \\ 20 \\ 9 \end{pmatrix}$$

Kawunga won the tournament

13. (a) Make d the subject of the expression

$L = \sqrt{\frac{3B}{T-D}}$

Squaring both sides

$L^2 = \left(\sqrt{\frac{3B}{T-D}}\right)^2$

$\frac{L^2}{1} = \frac{3B}{T-D}$

By cross multiplication

$T - D = \frac{3B}{L^2}$

$D = T - \frac{3B}{L^2} = \frac{L^2T-3B}{L^2}$

Hence, find the value of D when B = 540, L = 18 and T = 17

By substitution

$D = \frac{L^2T-3B}{L^2} = \frac{18^2(17)-3(540)}{18^2} = \frac{5508-1620}{324} = 12$

(b) Auma bought 5 sachets of washing powder and a tube of toothpaste at shs. 1,700 in January

In February she bought 15 sachets of washing power and 2 tubes of toothpaste at shs. 4,400. What is the cost of each item during the two months? (06marks)

Let x = price of a sachet of washing powder

y = price of a tube of toothpaste

5x + y = 1700 ……………. (i)

15x + 2y = 4400 …………. (ii)

Using elimination method

Subtracting 2eqn. (i) from eqn. (ii)

5x = 1000; x = 200

Substituting x = 200 in equation (i)

5 x 200 + y = 1700

y = 1700 -1000 = 700

Hence the price of 1 sachet of washing powder =shs. 200 while that of a tube of toothpaste = shs 700

Using matrix method

Let x = price of a sachet of washing powder

y = price of a tube of toothpaste

5x + y = 1700

15x + 2y = 4400

$\begin{pmatrix} 5 & 1 \\ 15 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1700 \\ 4400 \end{pmatrix}$

Determinant of matrix = 5 x 2 – 15 x 1 = -5

Adjunct matrix = $\begin{pmatrix} 2 & -1 \\ -15 & 5 \end{pmatrix}$

Inverse matrix =$\frac{1}{-5}\begin{pmatrix} 2 & -1 \\ -15 & 5 \end{pmatrix}$

Pre-multiplication both sides with inverse matrix

$\frac{1}{-5}\begin{pmatrix} 2 & -1 \\ -15 & 5 \end{pmatrix}\begin{pmatrix} 5 & 1 \\ 15 & 2 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \frac{1}{-5}\begin{pmatrix} 2 & -1 \\ -15 & 5 \end{pmatrix}\begin{pmatrix} 1700 \\ 4400 \end{pmatrix}$

$$\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix} = \frac{1}{-5}\begin{pmatrix}3,400 - 4,400\\-25,500 + 2200\end{pmatrix} = \frac{1}{-5}\begin{pmatrix}-1000\\-3500\end{pmatrix}$$

$$\begin{pmatrix}x\\y\end{pmatrix} = \begin{pmatrix}200\\700\end{pmatrix}$$

Hence the price of 1 sachet of washing powder =shs. 200 while that of a tube of toothpaste = shs 700

Using substitution method

5x + y = 1700 …………….. (i)

15x + 2y = 4400 ………….. (ii)

From eqn. (i)

x = $\frac{1700-y}{5}$

Substituting x in eqn.(ii)

15$\left(\frac{1700-y}{5}\right)$ + 2y = 4400

5100 – 3y + 2y = 4400

y = 5100 -4400 = 700

substituting y in eqn. (i)

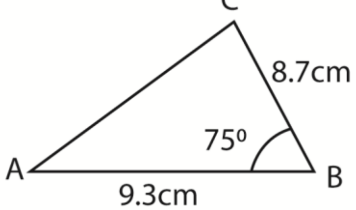
5x + 700 =1700

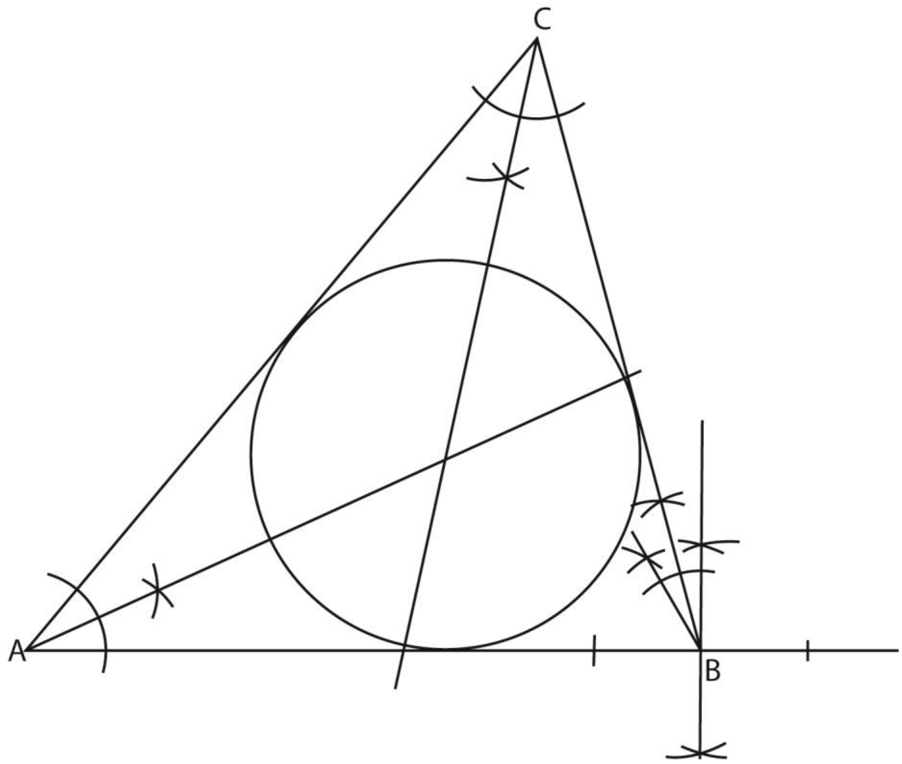
x = 200

Hence the price of 1 sachet of washing powder =shs. 200 while that of a tube of toothpaste = shs 700

14. Using a ruler, a pencil and a pair of compasses only,
    (a) Construct a triangle ABC, where ABC = 75$^0$, $\overline{AB} = 9.3cm$, $\overline{BC} = 8.7cm$ (05marks)

Sketch






(b) Measure the length Ac and angle ACB. (02 marks)

$\overline{AC} = 11cm, < ACB = 54^0$

(c) (i) Draw an inscribed circle in the triangle ABC.

(iii) Find the radius of the circle. (05marks)

$Radius = 2.6cm$

15. A cupboard has 5 white cups and 3 black cups. Two cups are picked from the cupboard one after the other without replacement.

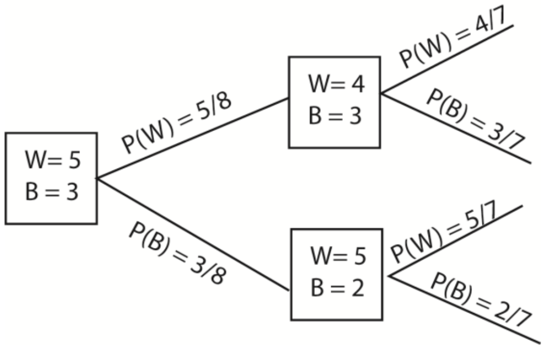
(a) Draw a tree diagram to represent the given information (05marks)

Let W = white cups and B = black cups

W = 3, B =3; total = 8

P(W) = $\frac{5}{8}$ and P(B) = $\frac{3}{8}$

1st picking 2nd picking




(b) Calculate the probability of picking

(iv) one white cup and one black cup

P(one white and one black)

= $P(W \cap B) + P(B \cap W)$

$= \frac{5}{8}\ x \frac{3}{7} + \frac{3}{8}\ x\ \frac{5}{7} = \frac{15}{56} + \frac{15}{56} = \frac{30}{56} = \frac{15}{28}$

(v) two cups of the same colour

P (two cups of same colour

$= P(W \cap W) + P(B \cap B)$

$= \frac{5}{8}\ x \frac{4}{7} + \frac{3}{8}\ x\ \frac{2}{7} = \frac{20}{56} + \frac{6}{56} = \frac{26}{56} = \frac{13}{28}$

(vi) at least one white cup. (07 marks)

P(at least one cup is white)

$= P(W \cap W) + P(W \cap B) + (B \cap W)$

$= \frac{5}{8}\ x \frac{4}{7} + \frac{5}{8}\ x\ \frac{3}{7} + \frac{3}{8}\ x\ \frac{5}{7} = \frac{20}{56} + \frac{15}{56} + \frac{15}{56} = \frac{50}{56} = \frac{25}{28}$

Or

$1 - (B \cap B)$

$1 - \frac{3}{8}\ x\ \frac{2}{7}$

$1 - \frac{6}{50} = \frac{50}{56} = \frac{25}{28}$

16. A triangle whose vertices are P, Q and R is mapped on a triangle whose vertices are P'(0, 1), Q'(5, 7) and R'(0, 2) by matrix of transformation $\begin{pmatrix} 3 & -1 \\ 4 & -1 \end{pmatrix}$. The triangle P'Q'R' is then mapped onto triangle P''Q''R'' by matrix transformation $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.

Find the;

(a) Coordinates of P'', Q'' and R''. (03marks)

P' Q' R' P'' Q'' R''

$$\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} 0 & 5 & 0 \\ 1 & 7 & 2 \end{pmatrix} = \begin{pmatrix} 0+0 & 10+0 & 0+0 \\ 0+8 & 0+14 & 0+4 \end{pmatrix} = \begin{pmatrix} 0 & 10 & 0 \\ 2 & 14 & 4 \end{pmatrix}$$

Hence P''(0, 2), Q''(10, 14) and R''(0, 4)

(b) Single matrix transformation which would map P''Q''R'' back onto PQR. (04marks)

The matrix that maps P''Q''R'' back onto PQR is the inverse matrix of

$$\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} 3 & -1 \\ 4 & -1 \end{pmatrix} = \begin{pmatrix} 6+0 & -2+0 \\ 0+8 & 0-2 \end{pmatrix} = \begin{pmatrix} 6 & -2 \\ 8 & -2 \end{pmatrix}$$

Determinant of matrix = -2 x 6 – 8 -2 = -12 + 16 = 4

Adjunct matrix $= \begin{pmatrix} -2 & 2 \\ -8 & 6 \end{pmatrix}$

Inverse matrix $= \frac{1}{4}\begin{pmatrix} -2 & 2 \\ -8 & 6 \end{pmatrix} = \begin{pmatrix} -0.5 & 0.5 \\ -2 & 1.5 \end{pmatrix}$

Hence the single matrix of transformation that maps P''Q''R'' to PQR is $\begin{pmatrix} -0.5 & 0.5 \\ -2 & 1.5 \end{pmatrix}$

(c) Coordinates of P, Q and R. (05marks)

The inverse matrix of matrix $\begin{pmatrix} 3 & -1 \\ 4 & -1 \end{pmatrix}$ maps P'Q'R' to PQR

Determinant of matrix = 3 x -1 –4 x -1 = -3 + 4 = 1

Adjunct matrix $= \begin{pmatrix} -1 & 1 \\ -4 & 3 \end{pmatrix}$

Inverse matrix $= \frac{1}{1}\begin{pmatrix} -1 & 1 \\ -4 & 3 \end{pmatrix} = \begin{pmatrix} -1 & 1 \\ -4 & 3 \end{pmatrix}$

P' Q' R' P Q R

$$\begin{pmatrix} -1 & 1 \\ -4 & 3 \end{pmatrix}\begin{pmatrix} 0 & 5 & 0 \\ 1 & 7 & 2 \end{pmatrix} = \begin{pmatrix} 0+1 & -5+7 & 0+2 \\ 0+3 & -20+21 & 0+6 \end{pmatrix} = \begin{pmatrix} 1 & 2 & 2 \\ 3 & 1 & 6 \end{pmatrix}$$

Hence P(1, 3), Q(2, 1) and R(2, 6)

17. An investor wants to buy 2 types of generators A and B. generator a needs 2m2 of space and B needs 3m2. The available space is only 60m2. The cost of a is $2,000 and that of B is $10,000. The investor has $880,000 to spend. If x and y represent number of generators of type A and B respectively.

(a) Write down four inequalities from the information given (04marks)

Space

$2x + 3y \leq 60$ ………………………………… (i)

Cost

$2{,}000x + 10{,}000y \leq 80{,}000$ ……………..(ii)

For non-negativity

$x \geq 0$……………………………………………. (iii)

$y \geq 0$……………………………………………. (iv)

(b) Represent the four inequalities on the same axes. (06marks)

For $2x + 3y \leq 60$

The boundary line

| | | |
|---|---|---|
| X | 0 | 30 |
| y | 20 | 0 |

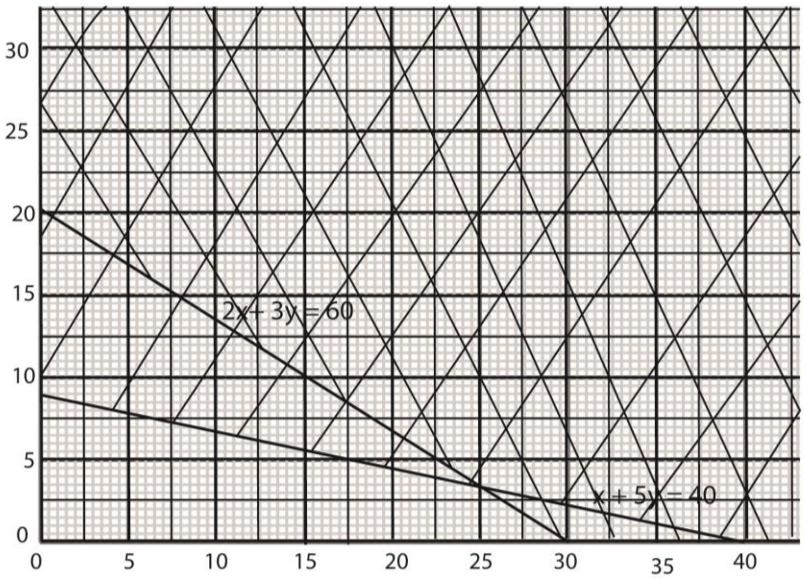
For $2{,}000x + 10{,}000y \leq 80{,}000$

Boundary line

$2{,}000x + 10{,}000y = 80{,}000$

$x + 5y = 40$

| | | |
|---|---|---|
| X | 0 | 40 |
| y | 8 | 0 |




(c) Find the greatest number of generators of both type A and B that the investor can by using the minimum amount of money. (02marks)

Possible points of maximization are (0, 8), (25 3), (27, 2) and (30, 0)

| Combination | Cost function= 2000x + 10,000y |
|---|---|
| (0, 8) | 0 + 8 x 10, 10,000 = 80,000 |
| (25, 3) | 25 x 2000 + 3 x 10,000 = 80,000 |
| (27, 2) | 27 x 2000 + 2 x 10,000 = 74,000 |
| (30, 0) | 30 x 2,000 + 0 = 60,000 |

Possible combination where both generators must be purchased o yield minimum cost is (27, 2).

Thank you

Dr. Bbosa Science