

1704/202
MATHEMATICS II
Oct./Nov. 2018
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
CRAFT CERTIFICATE IN BUILDING TECHNOLOGY
MODULE II

MATHEMATICS II

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Mathematical tables/non programmable scientific calculator;

Drawing instruments.

*This paper consists of **EIGHT** questions.*

*Answer **FIVE** questions.*

All questions carry equal marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.



This paper consists of 6 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) A bag contains 7 black, 5 green and 9 red marbles. Three marbles are picked one at a time with replacement.

(i) represent the above in a tree diagram.

(ii) determine the probability of picking:

I. all red;

II. two green and one red in that order.

(12 marks)

(b) Thirty students in class taking certificate in Building Technology had their heights recorded as follows:

120 • 127 • 125 • 125 • 128 • 127 •
 104 • 100 • 108 • 116 • 103 • 116 •
 112 • 110 • 121 • 101 • 152 • 126 •
 151 • 128 • 102 • 150 • 142 • 150 •
 112 • 133 • 140 • 128 • 152 • 140 •

(i) Make a frequency table starting with class interval of 100 - 109.

(ii) Find the mean height of the class.

(8 marks)

2. (a) The table 1 represents the failing strength of 100 concrete cubes tested in a laboratory.

Table 1

Class	Frequency
3.8 - 4.0	12
4.1 - 4.3	10
4.4 - 4.6	16
4.7 - 4.9	20
5.0 - 5.2	18
5.3 - 5.5	14
5.6 - 5.8	6
5.9 - 6.1	4

Determine:

(i) modal class;

(ii) the mean failing strength;

(iii) the standard deviation.

(8 marks)

- (b) The value of a poker vibrator that was purchased in January 2009, depreciates at 12% per annum. If its value in January 2011 was Ksh 48,400, find the purchase price of the poker vibrator. (4 marks)
- (c) Four trade partners from Europe, Japan, USA and South Africa contributed 2,000 Sterling Pounds (£), 5,000 US (\$) dollars, 100,000 Japanese Yen and 20,000 South African Rand respectively. They converted all the currencies into Kenyan shillings and paid customs duty of 30% on goods they bought at Ksh 500,000. Calculate the cash balance in US (\$) dollars they have using the exchange rates given in table 2. (8 marks)

Table 2

Currency	Kenya Shillings
1 Sterling £	140.9997
1 US \$	90.7031
100 JPY	75.3598
1 SA Rand	7.8066

Handwritten calculations for question (c):
 $2000 \times 140.9997 = 281,999.4$
 $5000 \times 90.7031 = 453,515.5$
 $100,000 \times 75.3598 = 7,535,980$
 $20,000 \times 7.8066 = 156,132$
 Total = 8,427,627.4
 After 30% duty: $8,427,627.4 \times 0.7 = 5,899,339.18$
 Balance: $5,899,339.18 - 500,000 = 5,399,339.18$
 In US dollars: $5,399,339.18 / 90.7031 \approx 59,538.50$

3. (a) Simplify the expression:
 $2 \sin 27^\circ \cos 27^\circ$. (3 marks)
- (b) If $\sin A = \frac{40}{41}$ and $\sin B = \frac{5}{13}$. Find without using tables or calculator:
 (i) $\sin(A + B)$;
 (ii) $\cos(A + B)$. (8 marks)



Handwritten calculations for question 3(b):
 $\sin A = \frac{40}{41} \Rightarrow \cos A = \frac{9}{41}$
 $\sin B = \frac{5}{13} \Rightarrow \cos B = \frac{12}{13}$
 $\sin(A+B) = \sin A \cos B + \cos A \sin B = \frac{40}{41} \times \frac{12}{13} + \frac{9}{41} \times \frac{5}{13} = \frac{480}{533} + \frac{45}{533} = \frac{525}{533}$
 $\cos(A+B) = \cos A \cos B - \sin A \sin B = \frac{9}{41} \times \frac{12}{13} - \frac{40}{41} \times \frac{5}{13} = \frac{108}{533} - \frac{2000}{533} = \frac{-1892}{533}$

- (c) The shaded area in figure 1 is to be tiled.

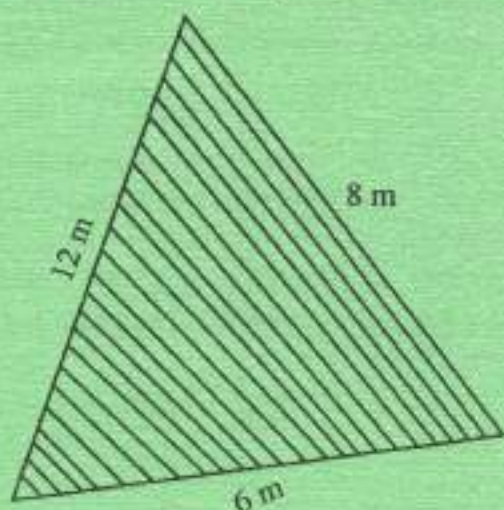


Fig. 1

- (i) Find the area to be covered by tiles;
- (ii) If the cost of tiling a square metre is Ksh 2,200 and 15% is allowed for tile breakages, calculate the cost of tiling the areas.
- (iii) If the contractor has to make a profit of 40% of the total cost, calculate the amount he should put in his quotation. (9 marks)

4. (a) Solve the trigonometric equation for values of θ between 0° and 360° .

$$\cos \theta = 13 \sin^2 \theta - 7. \quad (8 \text{ marks})$$

- (b) Express $7 \sin \theta + 13 \cos \theta$ in the form $R \sin(\theta + \alpha)$ where α is acute angle. Hence solve the equation:

$$7 \sin \theta + 13 \cos \theta = 3 \text{ for the values of } \theta \text{ from } 0^\circ \text{ to } 360^\circ \text{ inclusive.} \quad (12 \text{ marks})$$

- 5/ (a) Given the matrices:

$$A = \begin{pmatrix} 13 & 7 \\ -6 & 4 \end{pmatrix}, \quad B = \begin{pmatrix} 9 & 8 \\ 12 & 10 \end{pmatrix} \text{ and } C = \begin{pmatrix} 11 & -7 \\ -8 & 5 \end{pmatrix};$$

Find:

- (i) $3A + B - C$;
- (ii) AC ;
- (iii) AC^{-1} .

(9 marks)

(b) Use the results obtained in a (iii) above to solve:

$$87x - 56y = -50$$

$$62y - 98x = 52$$

(5 marks)

(c) A mason used 3 bags of lime and 2 bags of cement in day one and 5 bags of lime and 3 bags of cement in day two during plastering. If the cost of lime and cement in day one is Ksh 3,050 and in day two is Ksh 4,800; use matrix to find the cost of lime and cement.

(6 marks)

3L + 2C = 3050
 5L + 3C = 4800
 3L + 2C = 3050
 -6L + 4C = 6100
 15:10:5
 3L + 2C = 3050
 3L + 2C = 3050
 3L + 2C = 3050

6/ (a) Given the vectors:

(i) $A = 3i + 2j$;

(ii) $8i + 5j$.

Find the magnitude of direction of vector $3A + B$.

(6 marks)

(b) POR is a triangle as shown in figure 2. $\vec{OR} = r$ and $\vec{OP} = p$. $5\vec{PM} = 2\vec{PO}$ and $\vec{MK} = 2\vec{KR}$. Find the position vector of K in terms of p and r .

(6 marks)

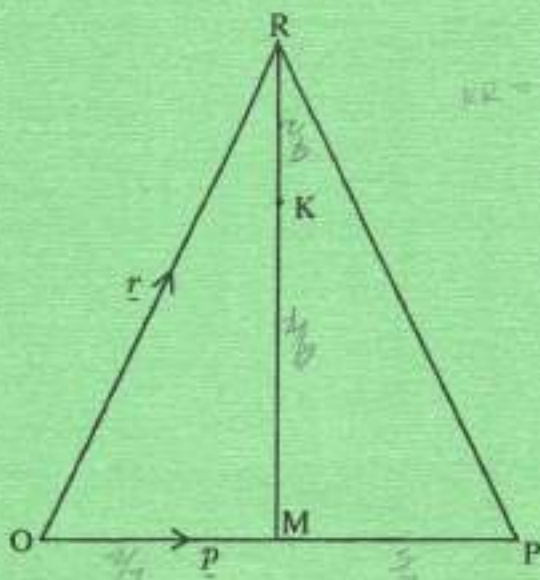


Fig. 2

$\vec{OR} = -\vec{PO} + \frac{2}{3}\vec{PR} + \vec{PM}$

0.50 10000
 2350
 10000
 10000

5.2
 5.3

- (c) **Figure 3** represents a system of four forces acting on a particle. By calculations, determine the magnitude and direction of the resultant force. (8 marks)

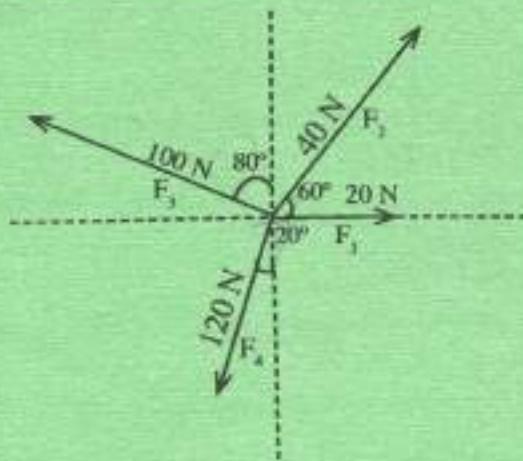


Fig. 3

$100 \cos 80^\circ = 17.36$
 $100 \sin 80^\circ = 98.48$
 $40 \cos 60^\circ = 20$
 $40 \sin 60^\circ = 34.64$
 $20 \cos 0^\circ = 20$
 $20 \sin 0^\circ = 0$
 $120 \cos 20^\circ = 112.76$
 $120 \sin 20^\circ = 41.41$



- 7/ (a) Differentiate the following:

(i) $y = \sqrt{3 - 3x}$;

(ii) $y = \frac{\cos 3x}{(1 - x^2)^{1/2}}$

(8 marks)

- (b) A closed tank with square base is to have a volume of 300 m^3 . The material for the top and bottom will cost Ksh 400 per square metre while the other sides will cost Ksh 500 per square metre. Determine the dimension that will minimize the cost.

(6 marks)

- (c) The volume of a cylinder is given by $V = \pi r^2 h$. Determine the approximate change in volume if the radius is reduced from 70 cm to 69 cm and the height is increased from 50 cm to 70 cm.

(6 marks)

- 8/ (a) Evaluate the following definite integrals:

(i) $\int_1^5 (6z^2 - 15z + 7) dz$;

(ii) $\int_0^{\pi} 3 \sin 2x \, dx$

(8 marks)

- (b) Find the area bounded by the curve $y = x^2 + 2$ and the axis between $x = 1$ and $x = 4$.

(6 marks)

- (c) A body moves with velocity $V = 2 + 8t$ metres per second, after t seconds. Find the:

- (i) distance moved in first three seconds;
 (ii) distance travelled in the fourth second.

(6 marks)

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