

Name _____ Index No. _____/_____

2705/102

Candidate's Signature _____

2707/102

2709/102

Date _____

MATHEMATICS AND PHYSICAL SCIENCE

Oct/Nov 2012

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**DIPLOMA IN BUILDING TECHNOLOGY
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN ARCHITECTURE
(MODULE I)**

MATHEMATICS AND PHYSICAL SCIENCE

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.

Sign and write the date of the examination in the spaces provided above.

You should have mathematical table(s)/scientific calculator for this examination.

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

*Answer any **FIVE** questions in the spaces provided in this question paper.*

***ALL** questions carry equal marks.*

Maximum marks for each part of a question are as shown.

For Examiner's Use Only

| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | TOTAL |
|----------|---|---|---|---|---|---|---|---|-------|
| Marks | | | | | | | | | |

This paper consists of 20 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) (i) Transpose the formula

$$\frac{D}{d} = \sqrt{\frac{(f+p)}{(f-p)}} \text{ to make } f \text{ the subject.} \quad (3 \text{ marks})$$

- (ii) Solve the simultaneous equations

$$\begin{aligned} 7x - 2y &= 17 \\ 6x + 5y &= 28 \end{aligned} \quad (3 \text{ marks})$$

- (iii) Simplify $\frac{x^4 + y^4}{x + y}$ (2 marks)

- (b) (i) Evaluate

$$\frac{\log 125 - \log 625 + \frac{1}{2} \log 3125}{3 \log 5} \quad (3 \text{ marks})$$

- (ii) Solve the equation

$$x^{12} = 41.25, \text{ correct to four significant figures.} \quad (3 \text{ marks})$$

- (c) Find the sum of all the numbers between 0 and 210 which are exactly divisible by 3. (6 marks)

2. (a) Two washers are drawn in turn with replacement from a box containing 74 brass washers, 86 steel washers and 40 aluminium washers. Determine the probabilities of having:

- (i) a brass and a steel washer;
 (ii) no aluminium washers;
 (iii) brass washer on the first draw but the second draw not an aluminium washer. (7 marks)

- (b) A team of four is chosen at random from five girls and six boys. In how many ways can the team be chosen if there must be more boys than girls? (3 marks)

- (c) The masses of 100 castings were determined with the following results:

| Masses (kg) | Frequency (f) |
|-------------|---------------|
| 5 - 10 | 5 |
| 10 - 15 | 10 |
| 15 - 20 | 18 |
| 20 - 25 | 26 |
| 25 - 30 | 23 |
| 30 - 35 | 12 |
| 35 - 40 | 6 |

Determine the:

- (i) mean;
- (ii) mode;
- (iii) median. (10 marks)

3. (a) Given the vectors $r_1 = 4i - 3j + 2k$, $r_2 = 3i - 4j - 3k$ and $r_3 = -2i + 3j + 3k$. Determine the:

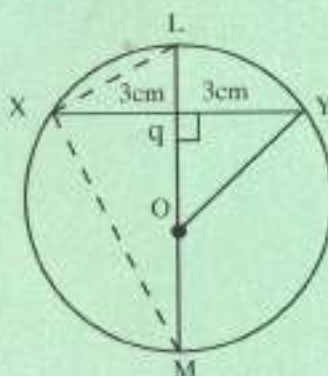
- (i) magnitude of
- (I) $r_1 + r_2 + r_3$
- (II) $2r_1 - 3r_2 - 5r_3$
- (ii) Unit vector parallel to the resultant of vectors r_1 and r_2 . (8 marks)

- (b) Describe the equation to the locus of a point which is always equidistant from the two points (0,0) and (4,5). (6 marks)

- (c) A geographical globe has a radius of 15 cm, and A and B are two point on its surface. A piece of string stretches from A (60°N , 90°W) to B (60°N , 90°E) passing over the north pole. Another piece of string is placed along the parallel of latitude from A to B. Determine the lengths of the two pieces of string, taking π to be $\frac{22}{7}$. (6 marks)

4. (a) A regular bar has a regular hexagonal section. A circular hole of radius 3.5 cm is bored centrally through the bar. If the width of the flat of the hexagon is 7 cm, calculate the volume of the bar if its length is 1m. (7 marks)

- (b) Figure 1 shows a circle centre O radius 3.4 cm. The chord XY is 6 cm long. LM is a perpendicular bisector of the chord. Calculate the lengths of XL and XM.



(7 marks)

- (c) Show that $\sin \theta = \frac{\sin 3\theta}{1 + 2 \cos 2\theta}$ (6 marks)

5. (a) Explain **three** applications of radioactive isotopes. (6 marks)

- (b) Describe **three** characteristic properties of electrovalent (or 10mc) compounds. (6 marks)

- (c) Describe **four** differences between oxidation and reduction in a chemical reactions. (8 marks)

6. (a) Describe **five** properties of acids. (10 marks)

- (b) Describe **five** processes that can be employed to soften hard water. (10 marks)

7. (a) Explain the difference between a concave and a convex lens. (6 marks)
- (b) Describe the **three** important rays that are used in diagrams for the location of images formed by lenses. (6 marks)
- (c) Define the following terms:
- (i) longitudinal sound waves;
 - (ii) transverse sound waves;
 - (iii) moment;
 - (iv) centre of gravity. (8 marks)
8. (a) An object 15 cm high is placed 25 cm from a converging lens of focal length 10 cm. By scale drawing, find the:
- (i) size of the image;
 - (ii) nature of the image;
 - (iii) magnitude of the image. (12 marks)
- (b) Identify the **two** main types of synthetic polymers and distinguish between them. (4 marks)
- (c) State the **four** types of atomic bonds. (4 marks)