



2705/102    2709/102  
2707/102    2710/102  
**MATHEMATICS I AND  
PHYSICAL SCIENCE**  
June/July 2018  
Time: 3 hours



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

**DIPLOMA IN BUILDING TECHNOLOGY  
DIPLOMA IN CIVIL ENGINEERING  
DIPLOMA IN ARCHITECTURE**

**MODULE I**

**MATHEMATICS I AND PHYSICAL SCIENCE**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Mathematical tables/ Scientific calculator;*

*Drawing instruments.*

*This paper consists of EIGHT questions in TWO sections: A and B.*

*Answer FIVE questions choosing TWO questions from section A, TWO questions from section B and ONE question from either section.*

*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 4 printed pages.**

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



## SECTION A: MATHEMATICS I

Answer at least **TWO** questions from this section.

1. (a) Solve  $3^{2x+5} = 8^{x-6}$  (5 marks)
- (b) Solve  $\log(9x^2 - 1) + 2\log x = \log(3x - 1) + \log x$  (7 marks)
- (c) Make  $r$  the subject of the formula.
- $$A = P\left(1 + \frac{r}{100}\right)^n$$
- (4 marks)
- (d) Given  $P(5, 6, -1)$ ,  $Q(-2, 4, 2)$  and  $R(1, 2, 3)$ . Write  $\underline{PQ}$  and  $\underline{PR}$  in terms of unit vectors. (4 marks)
2. (a) The following are the ages of 50 students in an engineering class.
- |    |    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|----|
| 20 | 25 | 30 | 29 | 31 | 21 | 26 | 51 | 41 | 20 |
| 22 | 31 | 32 | 28 | 27 | 26 | 20 | 22 | 22 | 31 |
| 23 | 25 | 27 | 26 | 26 | 22 | 21 | 23 | 27 | 29 |
| 25 | 29 | 20 | 27 | 24 | 23 | 39 | 33 | 34 | 24 |
| 25 | 28 | 24 | 28 | 20 | 24 | 20 | 31 | 25 | 26 |
- (i) Make a frequency distribution table starting with 20-24, 25-29 ...
- (ii) Draw an Ogive curve, then use it to estimate the median. (13 marks)
- (b) A bag contains 8 red balls and 6 blue balls. Two balls are drawn at random without replacement. Use a tree diagram to find the probability that:
- (i) the two balls are of the same colour.
- (ii) the first ball is red and the second ball is blue. (7 marks)
3. (a) Given that  $2n+1$ ,  $4n$  and  $5n+1$  are the first three terms in an arithmetic progression, find
- (i) the value of  $n$ ;
- (ii) the fifth term;
- (iii) the sum of the first 8 terms. (8 marks)
- (b) Express  $\frac{3x+6}{2x^2-x-1}$  as partial fractions. (7 marks)
- (c) Divide  $6x^3 + 7x^2 - 7x - 3$  by  $3x + 2$ . (5 marks)





4. (a) Solve the following simultaneous equations:  
 $x + 3y - z = -5$   
 $3x - y + 2z = 5$   
 $x + y + 2z = 3$  (9 marks)
- (b) Solve  $4\sin x + 3\cos x = 4$  for  $0 \leq x \leq 360^\circ$ . (9 marks)
- (c) How many ways can 5 people sit in a bench? (2 marks)

### SECTION B: PHYSICAL SCIENCE

Answer at least **TWO** questions from this section.

5. (a) Differentiate between core and valence electrons. (4 marks)
- (b) Name **three** types of primary bonds. (3 marks)
- (c) Outline the properties of covalent bonds. (6 marks)
- (d) With the aid of a sketch, describe the hydrogen bonds. (7 marks)
6. (a) List **three** kinds of radioactive decay. (3 marks)
- (b) Differentiate between nuclear fusion and nuclear fission. (4 marks)
- (c) The activity of mercury  $^{197}\text{Hg}$  is  $750 \text{ Bq}$ . Determine its activity after 80 seconds. (half-life 30.9 sec) (7 marks)
- (d) Outline **three** applications of radioactivity. (6 marks)
7. (a) Define the following terms:
- (i) acid salt;
  - (ii) amphoteric substance;
  - (iii) an alkali. (6 marks)
- (b) Using formulae, state **three** methods of salt preparation. (6 marks)
- (c) Describe **two** ways of softening hard water. (8 marks)



8. (a) State five properties of images formed by plane mirrors. (5 marks)
- (b) A concave mirror produces a real image 1 cm tall of an object 2.5 mm tall placed 5 cm from the mirror. Find the position of the image and the focal length of the mirror. (10 marks)
- (c) A vehicle travelling at an initial velocity of 20 km/h, accelerates at  $4 \text{ m/s}^2$ . Calculate its final velocity after 10 seconds. (5 marks)

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