

KENYA CERTIFICATE OF BASIC EDUCATION

SENIOR SCHOOL ASSESSMENT

DECEMBER ASSIGNMENT 2026

GRADE 10 – ESSENTIAL MATHEMATICS

Time: 2 Hours

LEARNER'S DETAILS

Name: _____, School: _____.

Assessment Number: _____, Date: _____.

School Code: _____, Signature: _____.

INSTRUCTIONS TO CANDIDATES

1. Write your full name in the space provided above.
2. Indicate your school, stream, admission number, and date clearly.
3. This paper has **TWO sections: A and B.**
4. Attempt **ALL questions** in both sections.
5. Show all working clearly where necessary.
6. Write all answers in the spaces provided.
7. Do NOT remove any page from this paper.

FOR OFFICIAL USE ONLY (EXAMINER'S USE)

SECTION	SECTION A	SECTION B	% SCORE	EE1	EE2	ME1	ME2	AE1	AE2	BE1	BE2
SCORE RANGE	30 MARKS	50 MARKS		90-100	75-89	58-74	41-57	31-40	21-30	11-20	1-10
POINTS				8 POINTS	7 POINTS	6 POINTS	5 POINTS	4 POINTS	3 POINTS	2 POINTS	1 POINT
TOTAL SCORE											

SECTION A (30 MARKS)

Answer ALL questions in this section.

1. (a) Without using a calculator, simplify the following expression into a single fraction in its lowest terms:

$$\frac{-2.4 \times (-1.5) + \frac{3}{5}}{\left(\frac{1}{2}\right)^{-3} \div 4}$$

[3 marks]

(b) Use a calculator to determine the reciprocal of 0.0325, giving your answer correct to 4 significant figures. [2 marks]

2. (a) Solve for x in the exponential equation:

$$9^{x+1} \times 3^{x-2} = 27^{2x-1} \quad \text{[3 marks]}$$

(b) Determine whether $\sqrt{18} \times \sqrt{2}$ is a rational or irrational number.

Show complete working to justify your answer. **[2 marks]**

3. A solid conical decorative piece has a base radius of 6 cm and a slant height of 10 cm.

(a) Calculate the total surface area of the cone in terms of π . [2 marks]

(b) Calculate the exact volume of the cone in terms of π . [3 marks]

4. Point $A(3, -2)$ is reflected across the mirror line $y = x$ to obtain point A' . Point A' is then reflected across the line $x = -1$ to obtain point A'' . Determine the **final coordinates** of point A'' . **[5 marks]**

5. In $\triangle PQR$, $PQ = 14$ cm, $PR = 9$ cm and the included angle $\angle QPR = 42^\circ$.

Calculate the area of $\triangle PQR$, giving your final answer correct to **2 decimal places**. **[5 marks]**

6. A bag contains:

- i 4 red marbles,
- ii 5 blue marbles, and
- iii 3 Green marbles.

Two marbles are drawn sequentially from the bag **without replacement**. Calculate the probability of drawing **one red marble and one blue marble in any order**. [5 marks]

SECTION B: 50 MARKS

Answer ALL questions in this section.

7. (a) A trader bought a laptop in the United States for USD 650.

On the day of purchase, the exchange rate was

$$1 \text{ USD} = 135.50 \text{ KES.}$$

The trader paid an import tax of 15% of the cost price in Kenya Shillings.

Calculate the **total cost of importing the laptop into Kenya**, in KES. [4 marks]

(b) The trader plans to sell the laptop in Kenya at a net profit margin of 20% on the total cost, including import tax.

Calculate the selling price of the laptop in KES. **[3 marks]**

If a customer pays for the laptop in Euros, given that 1 EUR = 145.20 KES, calculate the amount the customer pays in Euros.

Give your answer correct to **2 decimal places**. **[3 marks]**

8. (a) Solve the following quadratic equation by factorisation:

$$6x^2 - 11x - 35 = 0$$

[4 marks]

(b) A rectangular garden plot has a length that is 7 m longer than its width.

Let the original width be w metres.

The original length is therefore

$$(w + 7) \text{ m.}$$

If the length is reduced by 2 m and the width is doubled, the area of the new rectangular plot increases by 88 m^2 .

(i) Formulate a quadratic equation in terms of the original width w . [3 marks]

(ii) Solve the quadratic equation to determine the original dimensions of the garden. [3 marks]

9. Two geometrically similar solid pyramids, **Pyramid S** and **Pyramid L**, have base areas of 45 cm^2 and 180 cm^2 respectively.

(a) Find the area scale factor from Pyramid S to Pyramid L, giving your answer in its simplest form. [2 marks]

(b) Deduce the corresponding linear scale factor from Pyramid S to Pyramid L. [2 marks]

(c) If the height of Pyramid L is 24 cm, calculate the height of Pyramid S. [3 marks]

(d) Pyramid S has a volume of 120 cm^3 .

Calculate: [3 marks]

(i) the volume of Pyramid L; and

(ii) the capacity of Pyramid L in litres.

10. A surveyor standing at ground level at point X observes the top of a vertical tower T at an angle of elevation of 32° .

The surveyor then walks 40 m directly towards the base of the tower to point Y . From Y , the angle of elevation to the top of the tower increases to 54° .

(a) Draw a clearly labelled diagram showing:

- point X ;
- point Y ;
- the base of the tower B ;
- the top of the tower T ;
- the 40 m distance between X and Y ;
- the height h of the tower; and
- the angles of elevation 32° and 54° .

[3 marks]

(b) Let

$$YB = d \text{ m.}$$

Formulate **two trigonometric equations** involving h and d .

Hence, calculate the height h of the tower, correct to **2 decimal places**. **[5 marks]**

(c) Calculate the direct distance from point X to the top of the tower T , correct to 2 decimal places.

[2 marks]

11. The table below shows the marks obtained by **40 Grade 10 students** in a Mathematics assessment test.

Mark Range	Frequency f
10 – 19	4
20 – 29	7
30 – 39	12
40 – 49	11
50 – 59	6
Total	40

(a) Construct a complete frequency distribution table showing:

- Mark range;
- Midpoint x ;
- Frequency f ;
- Product fx ;
- Cumulative frequency cf .

[3 marks]

(b) Calculate the estimated mean mark of the distribution.

[3 marks]

(c) Two students are chosen at random from the class, one after another, without replacement.

Calculate the probability that:

(i) both students scored 30 marks or more; [2 marks]

(ii) one student scored in the 10 – 19 range and the other student scored in the 50 – 59 range. [2 marks]

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GRADE 10 ESSENTIAL MATHEMATICS

MARKING SCHEME

TOTAL MARKS: 80 MARKS

MARKING SYMBOLS / CODE

- *M* — Method mark: awarded for applying a correct mathematical method.
- *A* — Accuracy mark: awarded for a correct intermediate or final answer dependent on a method mark.
- *B* — Independent mark: awarded for a correct answer or statement regardless of method.

SECTION A: 30 MARKS

QUESTION 1 — [5 MARKS]

(a)

Step 1: Simplify the numerator.

$$-2.4 \times (-1.5) = 3.6 = \frac{18}{5}$$

[M1]

$$\text{Numerator} = 3.6 + 0.6 = 4.2 = \frac{21}{5}$$

Step 2: Simplify the denominator.

$$\left(\frac{1}{2}\right)^{-3} = 2^3 = 8$$

[M1]

$$\text{Denominator} = 8 \div 4 = 2$$

Step 3: Perform the division.

$$\frac{4.2}{2} = 2.1 = \frac{21}{10}$$

Therefore,

$$\boxed{2.1}$$

or

$$\boxed{2\frac{1}{10}}$$

[A1]

(b)

Step 1: Find the reciprocal.

$$\begin{aligned}\text{Reciprocal} &= \frac{1}{0.0325} \\ &= 30.76923 \dots\end{aligned}$$

[M1]

Step 2: Round to 4 significant figures.

$$\boxed{30.77}$$

[A1]

QUESTION 2 — [5 MARKS]

(a)

Step 1: Express all terms with a common base of 3.

$$(3^2)^{x+1} \times 3^{x-2} = (3^3)^{2x-1}$$

[M1]

Using the law

$$(a^m)^n = a^{mn},$$

we get:

$$3^{2x+2} \times 3^{x-2} = 3^{6x-3}$$

Step 2: Apply the law of indices for multiplication.

When multiplying powers with the same base, add the exponents:

$$3^{(2x+2)+(x-2)} = 3^{6x-3}$$

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

[M1]

Step 3: Equate the powers and solve for x .

$$3x = 6x - 3$$

$$3 = 3x$$

$$\boxed{x = 1}$$

[A1]

(b)

Step 1: Multiply the surds under a single radical.

$$\sqrt{18} \times \sqrt{2} = \sqrt{18 \times 2} = \sqrt{36}$$

[M1]

Step 2: Evaluate and state the classification.

$$\sqrt{36} = 6$$

Since

$$6 = \frac{6}{1},$$

6 can be expressed as a ratio of two integers.

Therefore, it is a:

Rational number

[A1]

QUESTION 3 — [5 MARKS]

(a) Total Surface Area of a Cone

Step 1: Use the formula

$$TSA = \pi r^2 + \pi r l$$

where

$$r = 6 \text{ cm}, \quad l = 10 \text{ cm}.$$

Base area:

$$\pi(6)^2 = 36\pi$$

Curved surface area:

$$\pi(6)(10) = 60\pi$$

[M1]

Step 2: Add the components.

$$TSA = 36\pi + 60\pi$$

$TSA = 96\pi \text{ cm}^2$

[A1]

(b) Volume of a Cone

Step 1: Find the perpendicular height h using Pythagoras' theorem.

$$h = \sqrt{l^2 - r^2}$$

$$= \sqrt{10^2 - 6^2}$$

$$= \sqrt{100 - 36}$$

$$= \sqrt{64}$$

$$h = 8 \text{ cm}$$

[M1]

Step 2: Apply the volume formula.

$$V = \frac{1}{3}\pi r^2 h$$

$$V = \frac{1}{3} \times \pi \times 6^2 \times 8$$

$$= \frac{1}{3} \times 36 \times 8 \times \pi$$

$$\boxed{V = 96\pi \text{ cm}^3}$$

[A1]

QUESTION 4 — [5 MARKS]

A point $A(3, -2)$ is reflected first in the line $y = x$, and then in the vertical line $x = -1$.

Step 1: Reflect $A(3, -2)$ in the line $y = x$.

The transformation rule is:

$$(x, y) \rightarrow (y, x)$$

Therefore,

$$A'(y, x) = (-2, 3)$$

$$\boxed{A' = (-2, 3)}$$

[M1] [A1]

Step 2: Reflect $A'(-2, 3)$ in the vertical line $x = -1$.

The distance from

$$x = -2$$

to

$$x = -1$$

is 1 unit.

The reflected point is therefore 1 unit on the opposite side of $x = -1$:

$$x'' = -1 + 1 = 0$$

Alternatively, use:

$$x'' = 2k - x$$

where $k = -1$:

$$x'' = 2(-1) - (-2)$$

$$= -2 + 2 = 0$$

[M1]

The y -coordinate remains unchanged:

$$y = 3$$

Step 3: State the final coordinates.

$$\boxed{A'' = (0,3)}$$

[A1]

QUESTION 5 — [5 MARKS]

Area of a Non-Right-Angled Triangle

Step 1: Identify the formula for the area of a triangle given two sides and the included angle (SAS).

$$\text{Area} = \frac{1}{2} ab \sin C$$

[M1]

Step 2: Substitute the given values.

Given:

$$a = 14, \quad b = 9, \quad C = 42^\circ$$

Therefore,

$$\text{Area} = \frac{1}{2} \times 14 \times 9 \times \sin 42^\circ$$

[M1]

Since

$$\sin 42^\circ = 0.6691306 \dots$$

$$\text{Area} = 63 \times 0.6691306 \dots$$

[M1]

Step 3: Calculate and round to 2 decimal places.

$$\text{Area} = 42.1552 \dots$$

$$\boxed{42.16 \text{ cm}^2}$$

[A1]

QUESTION 6 — [5 MARKS]

A container contains **4 red, 5 blue and 3 other marbles**. Two marbles are selected without replacement.

Step 1: Calculate the total number of marbles.

$$4 + 5 + 3 = 12$$

Therefore,

$$\text{Total marbles} = 12$$

Step 2: Calculate the probability of selecting Red then Blue.

$$P(R_1) = \frac{4}{12}$$

After selecting a red marble, 11 marbles remain, including 5 blue marbles:

$$P(B_2 | R_1) = \frac{5}{11}$$

Therefore,

$$\begin{aligned} P(R, B) &= \frac{4}{12} \times \frac{5}{11} \\ &= \frac{20}{132} \end{aligned}$$

[M1]

Step 3: Calculate the probability of selecting Blue then Red.

$$P(B_1) = \frac{5}{12}$$

After selecting a blue marble, 11 marbles remain, including 4 red marbles:

$$P(R_2 | B_1) = \frac{4}{11}$$

Therefore,

$$\begin{aligned} P(B, R) &= \frac{5}{12} \times \frac{4}{11} \\ &= \frac{20}{132} \end{aligned}$$

[M1]

Step 4: Add the probabilities of the two mutually exclusive paths.

$$\begin{aligned} P(\text{one Red and one Blue}) &= P(R, B) + P(B, R) \\ &= \frac{20}{132} + \frac{20}{132} \\ &= \frac{40}{132} \end{aligned}$$

[M1]

Step 5: Simplify.

$$P = \boxed{\frac{10}{33}}$$

[A1]

SECTION B: 50 MARKS

QUESTION 7 — [10 MARKS]

(a)

The base price is **650 EUR**, with an exchange rate of **1 EUR = 135.50 KES**.

Step 1: Convert the base price to Kenya Shillings.

$$\begin{aligned}\text{Price in KES} &= 650 \times 135.50 \\ &= \boxed{88,075 \text{ KES}}\end{aligned}$$

[M1]

Step 2: Calculate the 15% import tax.

$$\begin{aligned}\text{Tax} &= 15\% \times 88,075 \\ &= 0.15 \times 88,075 \\ &= \boxed{13,211.25 \text{ KES}}\end{aligned}$$

[M1]

Step 3: Calculate the total import cost.

$$\begin{aligned}\text{Total Cost} &= 88,075 + 13,211.25 \\ \boxed{\text{Total Cost} &= 101,286.25 \text{ KES}}\end{aligned}$$

[A1]

(b)

Step 1: Calculate the selling price with a 20% profit.

$$\begin{aligned}\text{Selling Price} &= 101,286.25 \times 1.20 \\ \boxed{\text{Selling Price} &= 121,543.50 \text{ KES}}\end{aligned}$$

[M1] [A1]

Step 2: Convert the selling price to Euros.

Given:

$$1 \text{ EUR} = 145.20 \text{ KES}$$

Therefore,

$$\begin{aligned}\text{Price in EUR} &= \frac{121,543.50}{145.20} \\ &= 837.0764 \dots\end{aligned}$$

[M1]

Step 3: Round to 2 decimal places.

$$\boxed{837.08 \text{ EUR}}$$

[A1]

QUESTION 8— [10 MARKS]

(a) Solve the quadratic equation

Step 1: Find two numbers whose product is

$$6 \times (-35) = -210$$

and whose sum is

$$-11.$$

The numbers are:

$$-21 \quad \text{and} \quad +10$$

[M1]

Step 2: Split the middle term and factorise by grouping.

$$6x^2 - 11x - 35 = 0$$

$$6x^2 - 21x + 10x - 35 = 0$$

$$3x(2x - 7) + 5(2x - 7) = 0$$

$$(3x + 5)(2x - 7) = 0$$

[M1]

Step 3: Solve for x .

$$3x + 5 = 0$$

$$3x = -5$$

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

OR

$$2x - 7 = 0$$

$$2x = 7$$

$$x = \frac{7}{2}$$

Therefore,

$$x = -\frac{5}{3} \quad \text{or} \quad x = \frac{7}{2}$$

or

$$x = -\frac{5}{3} \quad \text{or} \quad x = 3.5$$

[A1]

(b)

A rectangular area has its width doubled and its length reduced by 2 metres, resulting in an increase in area of 88 m^2 .

Step 1: Define the original dimensions.

Let the original width be:

$$w$$

Original length:

$$w + 7$$

Original area:

$$\begin{aligned} &w(w + 7) \\ &= w^2 + 7w \end{aligned}$$

[M1]

New width:

$$2w$$

New length:

$$(w + 7) - 2 = w + 5$$

New area:

$$\begin{aligned} &2w(w + 5) \\ &= 2w^2 + 10w \end{aligned}$$

[M1]

Step 2: Formulate the quadratic equation.

The increase in area is 88 m^2 :

$$\begin{aligned} \text{New Area} - \text{Original Area} &= 88 \\ (2w^2 + 10w) - (w^2 + 7w) &= 88 \\ w^2 + 3w &= 88 \end{aligned}$$

$$w^2 + 3w - 88 = 0$$

[A1]

Step 3: Solve the quadratic equation.

$$(w + 11)(w - 8) = 0$$

Therefore,

$$w = -11$$

or

$$w = 8$$

Since the width must be positive:

$$w = -11 \text{ is rejected}$$

Thus,

$$\boxed{w = 8 \text{ m}}$$

[M1] [A1]

Step 4: State the final dimensions.

Width:

$$\boxed{8 \text{ m}}$$

Length:

$$8 + 7 = 15$$

$$\boxed{15 \text{ m}}$$

[A1]

QUESTION 9 — [10 MARKS]

Two similar pyramids, S and L , have base areas 45 cm^2 and 180 cm^2 , respectively. The height of L is 24 cm , and the volume of S is 120 cm^3 .

(a) Area Scale Factor

Step 1: Calculate the ratio of the base areas.

$$\text{ASF} = \frac{\text{Area of } S}{\text{Area of } L}$$

$$= \frac{45}{180}$$

$$\boxed{\text{ASF} = \frac{1}{4}}$$

[B2]

(b) Linear Scale Factor

$$\text{LSF} = \sqrt{\text{ASF}}$$

$$= \sqrt{\frac{1}{4}}$$

$$\boxed{\text{LSF} = \frac{1}{2}}$$

[B2]

(c) Height of Pyramid S

Since the pyramids are similar:

$$\frac{\text{Height of } S}{\text{Height of } L} = \text{LSF}$$

Therefore,

$$\frac{h_S}{24} = \frac{1}{2}$$

[M1]

$$h_S = 24 \times \frac{1}{2}$$

$$\boxed{h_S = 12 \text{ cm}}$$

[A1]

(d) Volume and Capacity of Pyramid L

Step 1: Calculate the Volume Scale Factor.

$$\text{VSF} = (\text{LSF})^3$$

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

$$= \frac{1}{8}$$

[M1]

Therefore,

$$\text{Volume of } L = \text{Volume of } S \times 8$$

$$= 120 \times 8$$

$$\boxed{960 \text{ cm}^3}$$

[A1]

Step 2: Convert the volume to litres.

Given:

$$1000 \text{ cm}^3 = 1 \text{ litre}$$

Therefore,

$$\text{Capacity} = \frac{960}{1000}$$

$$\boxed{0.96 \text{ litres}}$$

[A1]

QUESTION 10 — [10 MARKS]

(a) Diagram

Award **3 marks** for a correct right-angled triangle arrangement showing:

- Vertical tower TB .
- Points X and Y on the ground line.
- $XY = 40$ m.
- Angle of elevation at $X = 32^\circ$.
- Angle of elevation at $Y = 54^\circ$.

[B3]

(b) Calculate the height of the tower.

Let the distance from the base B to Y be d .

Step 1: Set up tangent equations for triangles TBY and TBX .

For triangle TBY :

$$\tan 54^\circ = \frac{h}{d}$$

Therefore,

$$h = d \tan 54^\circ$$

$$h = 1.3764d$$

[M1]

For triangle TBX :

$$\tan 32^\circ = \frac{h}{d + 40}$$

Therefore,

$$h = (d + 40) \tan 32^\circ$$

$$h = 0.6249(d + 40)$$

[M1]

Step 2: Equate the two expressions for h .

$$1.3764d = 0.6249(d + 40)$$

$$1.3764d = 0.6249d + 24.996$$

$$1.3764d - 0.6249d = 24.996$$

$$0.7515d = 24.996$$

$$d = 33.26 \text{ m}$$

[M1]

Step 3: Calculate the height h .

$$h = 33.26 \times 1.3764$$

$$h = 45.779 \dots$$

Therefore,

$$\boxed{h = 45.78 \text{ m}}$$

[A1]

(c) Calculate the distance XT .

Using triangle TBX :

$$\sin 32^\circ = \frac{h}{XT}$$

Therefore,

$$XT = \frac{h}{\sin 32^\circ}$$

$$XT = \frac{45.78}{\sin 32^\circ}$$

Since

$$\sin 32^\circ = 0.5299 \dots$$

$$XT = \frac{45.78}{0.5299}$$

$$\boxed{XT = 86.39 \text{ m}}$$

[M1] [A1]

QUESTION 11 — [10 MARKS]

(a) Frequency Distribution Table

Mark Range	Frequency f	Midpoint x	$f \times x$	Cumulative Frequency cf
10–19	4	14.5	58	4
20–29	7	24.5	171.5	11
30–39	12	34.5	414	23
40–49	11	44.5	489.5	34

Mark Range	Frequency f	Midpoint x	$f \times x$	Cumulative Frequency cf
50–59	6	54.5	327	40
Total	40	—	1460	—

[B3]

Therefore,

$\Sigma f = 40$

and

$\Sigma fx = 1460$

(b) Estimated Mean Mark

Step 1: Apply the mean formula.

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$$\bar{x} = \frac{1460}{40}$$

[M1]

$\bar{x} = 36.5 \text{ marks}$

[A1]

(c) Probabilities

(i) Probability that both students score at least 30 marks

Students scoring 30 marks or more:

$$12 + 11 + 6 = 29$$

Therefore,

$$P(\text{first student} \geq 30) = \frac{29}{40}$$

After selecting one student, 39 students remain, of whom 28 scored at least 30:

$$P(\text{second student} \geq 30) = \frac{28}{39}$$

Therefore,

$$P(\text{Both} \geq 30) = \frac{29}{40} \times \frac{28}{39}$$

$$= \frac{812}{1560}$$

$$= \boxed{\frac{203}{390}}$$

Approximately,

$$\boxed{0.5205}$$

[M1] [A1]

(ii) Probability that one student scores 10–19 and the other scores 50–59

There are:

- 4 students in the **10–19** group.
- 6 students in the **50–59** group.

The two possible arrangements are:

First 10–19, then 50–59:

$$\frac{4}{40} \times \frac{6}{39} = \frac{24}{1560}$$

First 50–59, then 10–19:

$$\frac{6}{40} \times \frac{4}{39} = \frac{24}{1560}$$

Therefore,

$$P = \frac{24}{1560} + \frac{24}{1560}$$

$$= \frac{48}{1560}$$

$$= \boxed{\frac{2}{65}}$$

Approximately,

$$\boxed{0.0308}$$

[M1] [A1]

MARK SUMMARY

Section	Question	Marks
A	Question 1	5
A	Question 2	5
A	Question 3	5
A	Question 4	5
A	Question 5	5
A	Question 6	5
Section A Total		30
B	Question I	10
B	Question II	10
B	Question III	10
B	Question IV	10
B	Question V	10
Section B Total		50
GRAND TOTAL		80 MARKS

