



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P2

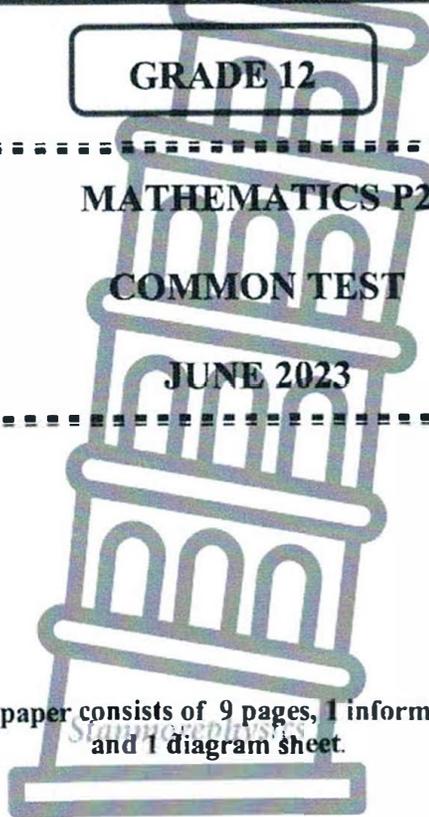
COMMON TEST

JUNE 2023

MARKS: 150

TIME: 3 hours

**N.B. This paper consists of 9 pages, 1 information sheet,
and 1 diagram sheet.**



INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of **9** questions.
2. Answer **ALL** the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers.
5. Answers only will **NOT** necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to **TWO** decimal places, unless stated otherwise.
8. Diagrams are **NOT** necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.



QUESTION 1

Seven scores for a test out of 50 marks were recorded. However, when recording the data the statistician had some difficulty with his computer. He listed the following conditions that he had remembered,

Scores	a	b	c	d	e	f	g
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- Maximum Value is 42
- Range is 35
- Median is 23
- The difference between the median and the upper quartile is 14
- The Inter – Quartile Range is 22
- $e = 2c$
- The mean is 25.

Determine the values of the scores. (Show all working)

(10)

[10]**QUESTION 2**

The class teacher of a grade 10 class collected the following data for her learners. She recorded the time taken by the learners to complete different tasks assigned.

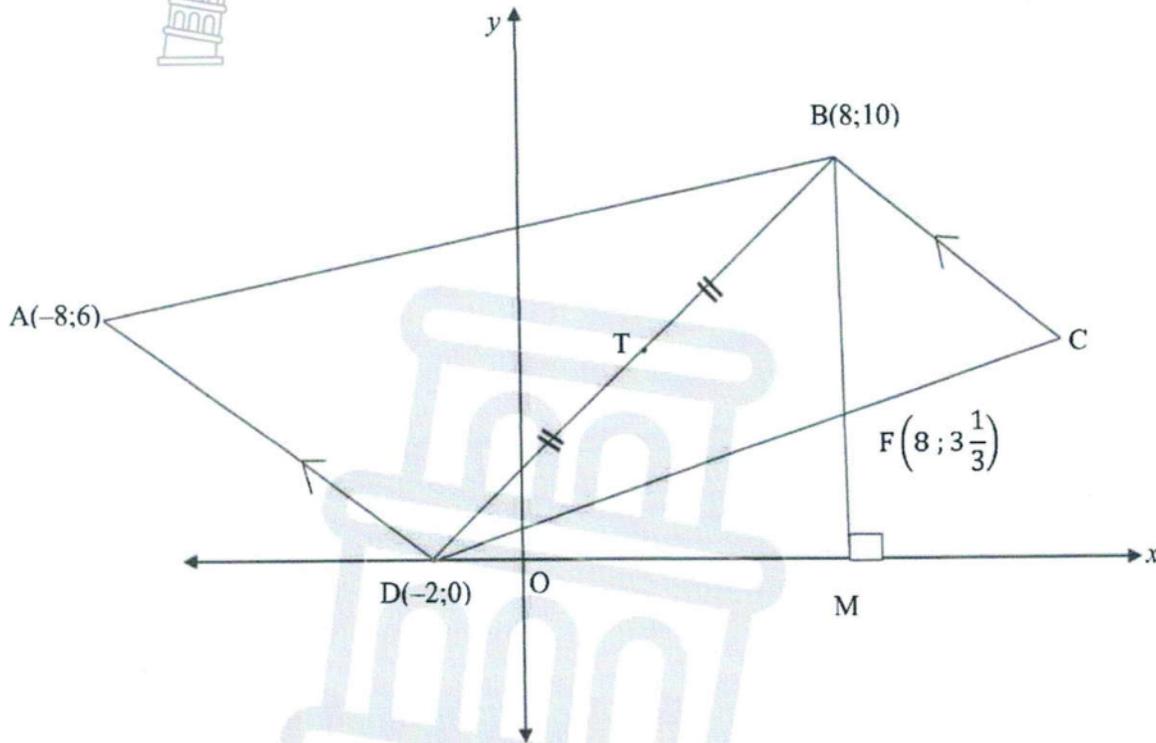
Time in minutes	No. of learners			
$0 < t \leq 10$	5			
$10 < t \leq 20$	8			
$20 < t \leq 30$	18			
$30 < t \leq 40$	7			
$40 < t \leq 50$	2			

- 2.1 Calculate the estimated mean time. (3)
- 2.2 Draw a frequency polygon (Ogive) curve on the system of axes provided. (5)
- 2.3 Calculate how many learners took more than 60 % of the time to complete the tasks assigned to them. (3)

[11]

QUESTION 3

In the sketch below, $A(-8;6)$, $B(8;10)$, C and $D(-2;0)$ are the vertices of a trapezium having $AD \parallel BC$. T is the midpoint of DB . From the vertex B , BM is drawn perpendicular to the x -axis and intersects DC in $F(8;3\frac{1}{3})$.

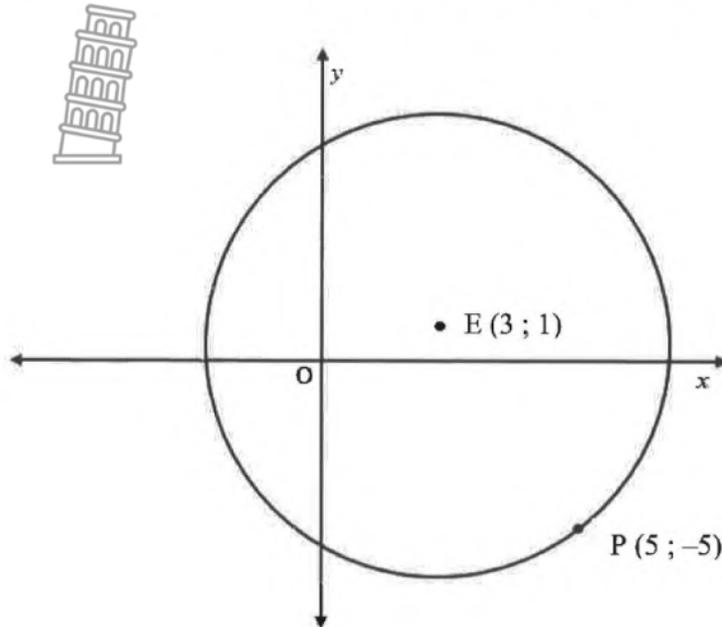


- 3.1 Calculate the gradient of AD . (2)
- 3.2 Determine the equation of BC in the form $y = mx + c$. (3)
- 3.3 Prove that $BD \perp AD$. (3)
- 3.4 Calculate the size of \widehat{BDM} . (2)
- 3.5 If $TC \parallel DM$ and points T and C are symmetrical about the line BM . Calculate the coordinates of C . (3)
- 3.6 Calculate the area of $\triangle BDF$. (5)

[18]

QUESTION 4

In the diagram below, the circle centred at E (3 ; 1) passes through the point, P (5 ; -5).



4.1 Determine the equation of :

4.1.1 The circle in the form $x^2 + y^2 + Ax + By + C = 0$. (4)

4.1.2 The tangent to the circle at P (5 ; -5) in the form $y = mx + c$. (5)

4.2 A smaller circle is drawn inside the circle. Line EP is the diameter of the small circle.

Determine the:

4.2.1 Coordinates of the centre of the smaller circle. (4)

4.2.2 Length of the radius. (2)

4.3 Hence, or otherwise, determine whether the point C(9 ; 3) lies inside, outside or on the circle centre, E.

(4)

[19]



QUESTION 5

5.1 If $\tan 12^\circ = q$, then determine the value of the following, without using a calculator:

5.1.1 $\cos 192^\circ$ (3)

5.1.2 $\cos 24^\circ$ (3)

5.1.3 $1 - 2\sin^2 6^\circ$ (2)

5.2 Evaluate the following trigonometric expression without using a calculator:

$$\frac{2 \sin^2(x - 180^\circ) \cos(180^\circ - x)}{\cos(90^\circ + x) \sin x - \cos(x - 90) \sin(720^\circ - x)} \quad (7)$$

5.3 Given: $(1 - \tan A) \left(\frac{\cos A}{\cos 2A} \right) = \frac{1}{\cos A + \sin A}$

5.3.1 Prove the identity. (3)

5.3.2 Write down the maximum value of $\frac{1}{\cos A + \sin A}$ (2)

5.4 Calculate the value of

$$\sum_{38^\circ}^{52^\circ} \cos^2 A \quad (4)$$

[24]

QUESTION 6

6.1 Sketch the graphs of $f(x) = \sin \frac{1}{2}x$ and $g(x) = \cos(x + 60^\circ)$ for $x \in [-180^\circ; 180^\circ]$ on the grid given at the back. (6)

6.2 Use your graphs to answer the following questions:

6.2.1 Write down the range of the graph of f . (2)

6.2.2 State the period of g . (1)

6.2.3 Determine the values of x for which $f(x) = g(x)$. (4)

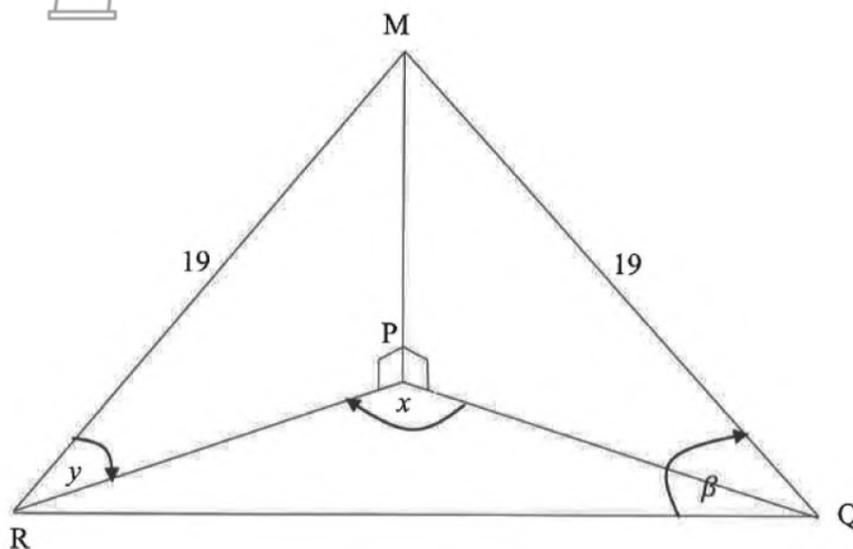
6.2.4 If $h(x) = g(x + 30^\circ)$, write down the equation of h . (3)

[16]

QUESTION 7

In the diagram below, MP is a vertical tower. MQ and MR are wire ropes used to stabilize MP and are each 19 metres in length. R, P and Q are in the same horizontal plane. The angle of elevation of M from R is y .

$\widehat{RPQ} = x$ and $\widehat{MQR} = \beta$



7.1 Prove that the Area of $\Delta PQR = \frac{361 \sin x \cos^2 y}{2}$ (5)

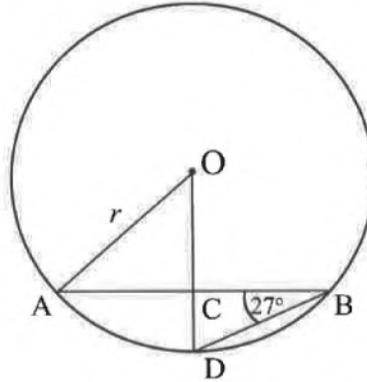
7.2 Show that, $RQ = 38 \cos \beta$ (6)

[11]



QUESTION 8

8.1 O is the centre of the circle, radius r , and chord $AB = \sqrt{128}$ cm. $OC \perp AB$ and $OC : CD = 3 : 2$. $\hat{A}BD = 27^\circ$



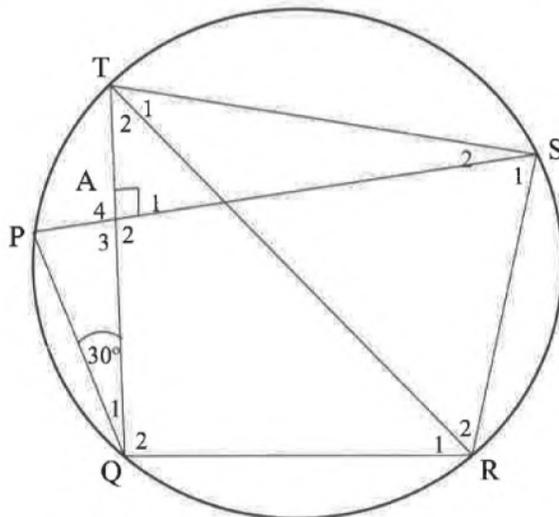
8.1.1 Calculate the length of the radius of the circle, without using a calculator. (5)

8.1.2 Calculate, with reason and $\hat{A}OD$. (2)

8.2 Complete the following statement: (2)

8.2.1 The exterior angle of a cyclic quadrilateral is

8.2.2 TQ is a chord of the circle PQRST. $QAT \perp PAS$. $\hat{Q}_1 = 30^\circ$ and $\hat{P} = \hat{S}_1$.



- a) Name 3 angles each equal to 60° . (3)
- b) Calculate the size of $\hat{Q}RS$. (2)
- c) Prove that $PS \parallel QR$. (2)
- d) Prove that TR is a diameter of the circle. (2)

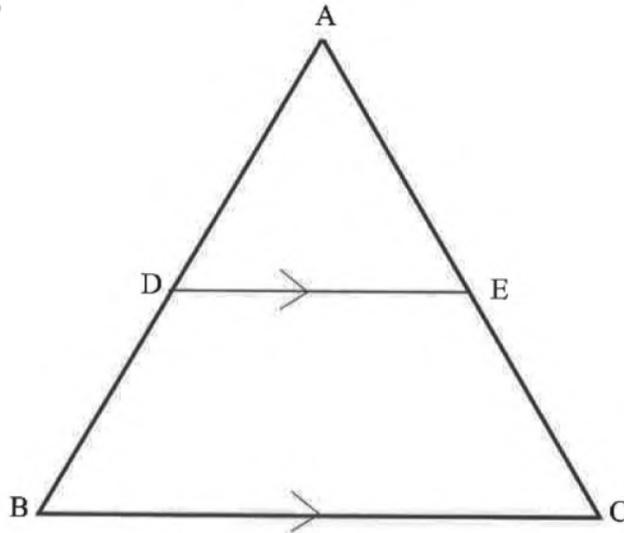


[18]

QUESTION 9

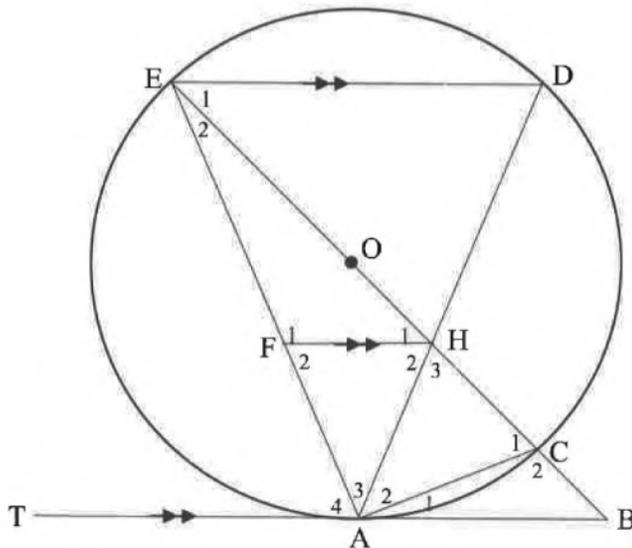
9.1 In ΔABC , $DE \parallel BC$. Prove :

$$\frac{AD}{DB} = \frac{AE}{EC}$$



(6)

9.2 In the diagram, O is the centre of the circle ACDE. EC is produced to B. TAB is a tangent to the circle at A. EC and AD intersect at H. F is a point on EA. $ED \parallel FH \parallel TAB$. EOHCB is a straight line. $AH : HD = 5 : 7$.



- 9.2.1 Prove $\Delta ABC \parallel \Delta EBA$ (4)
- 9.2.2 Calculate r , the radius of the circle, if $AB = 5$ metres and $BC = \frac{2r}{3}$ metres. (4)
- 9.2.3 Write down, with reason the value of $AF : FE$. (2)
- 9.2.4 Determine $\frac{\text{Area of } \Delta AFH}{\text{Area of } \Delta AED}$. (4)
- 9.2.5 Calculate the length of OH . (3)



[23]

TOTAL MARKS: 150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}(2a + (n - 1)d)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; \quad -1 < r < 1$$

$$F = \frac{x[(1 + i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1 + i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A \quad \text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2 \sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum f \cdot x}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

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

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

DIAGRAM SHEET

QUESTION 2

Time in minutes	No. of learners	
$0 < t \leq 10$	5	
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QUESTION 6.1

