



# **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	$a$	$b$	$c$	$d$	$e$	$f$	$g$
--------	-----	-----	-----	-----	-----	-----	-----

- 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)

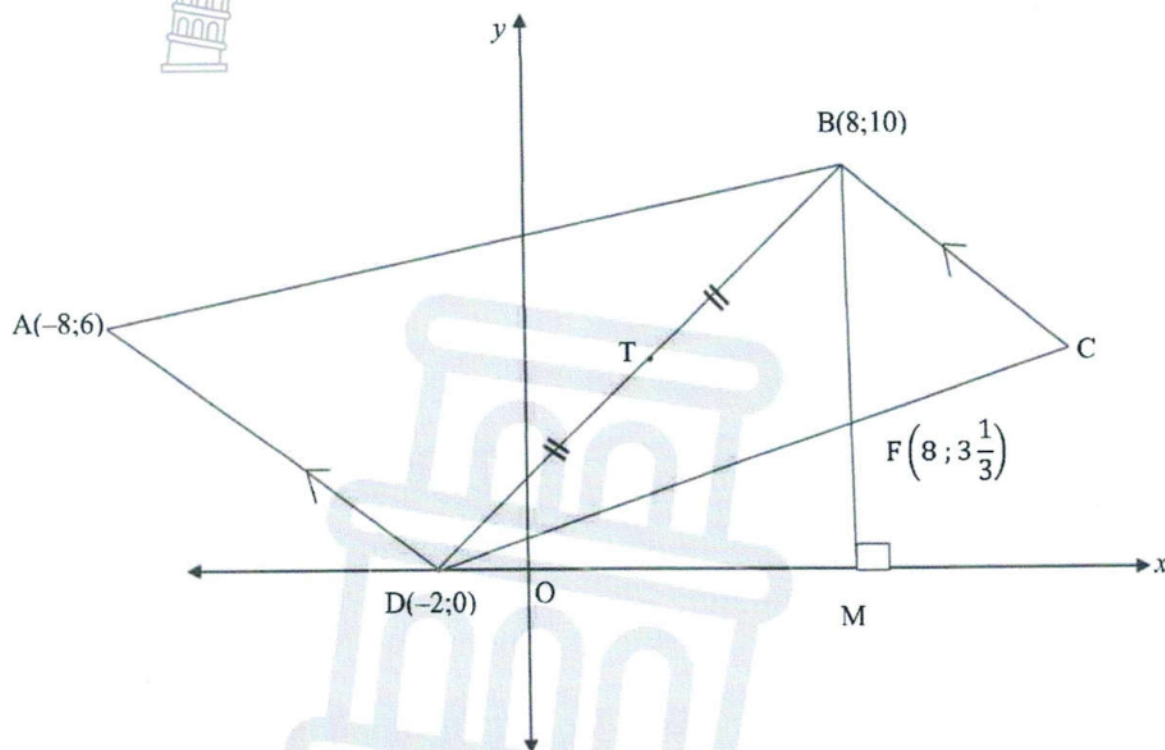
2.3 Calculate how many learners took more than 60 % of the time to complete the tasks assigned to them.

(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  $F\left(8;3\frac{1}{3}\right)$ .

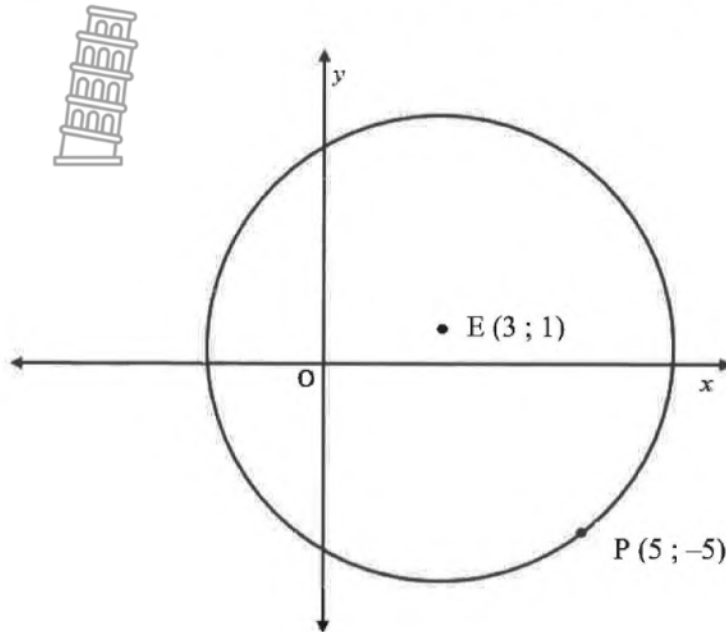


- 3.1 Calculate the gradient of AD. (2)
- 3.2 Determine the equation of BC in the form  $y = mx + c$ . (3)
- 3.3 Prove that  $BD \perp AD$ . (3)
- 3.4 Calculate the size of  $\widehat{BDM}$ . (2)
- 3.5 If  $TC \parallel DM$  and points T and C are symmetrical about the line BM. Calculate the coordinates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

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

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)

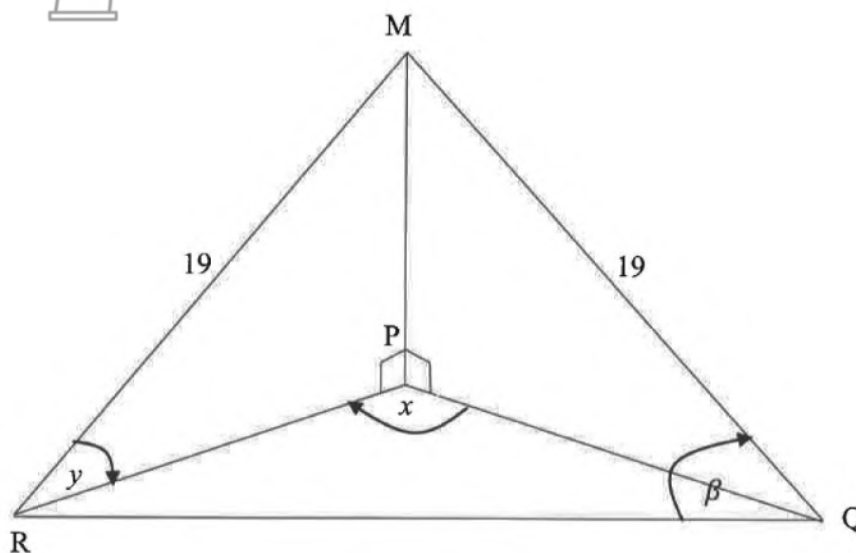
6.2.4 If  $h(x) = g(x + 30^\circ)$ , write down the equation of  $h$ . (3)

[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  $\triangle PQR = \frac{361 \sin x \cos^2 y}{2}$  (5)

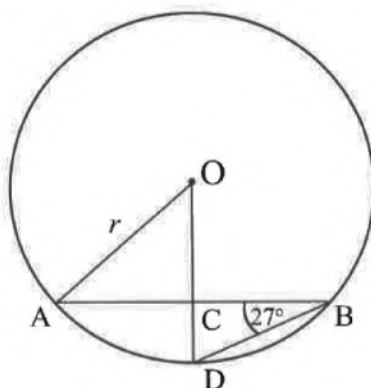
7.2 Show that,  $RQ = 38 \cos \beta$  (6)

[11]



# QUESTION 8

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



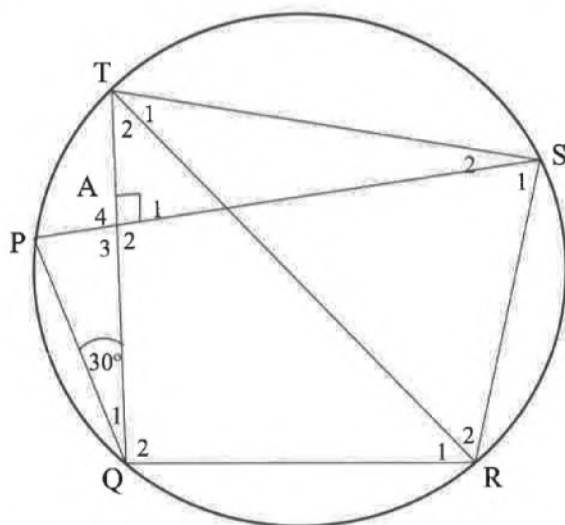
8.1.1 Calculate the length of the radius of the circle, without using a calculator. (5)

8.1.2 Calculate, with reason and  $\angle AOD$ . (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.  $QAT \perp PAS$ .  $\widehat{Q_1} = 30^\circ$  and  $\widehat{P} = \widehat{S_1}$ .



- Name 3 angles each equal to  $60^\circ$ . (3)
- Calculate the size of  $\widehat{QRS}$ . (2)
- Prove that  $PS \parallel QR$ . (2)
- Prove that TR is a diameter of the circle. (2)

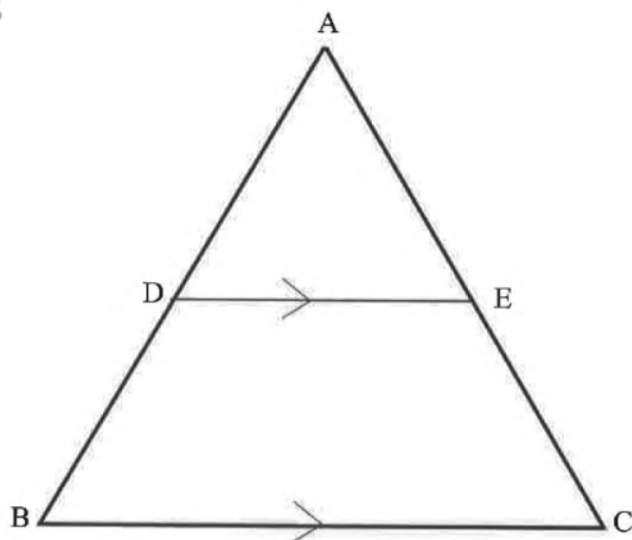
[18]



## QUESTION 9

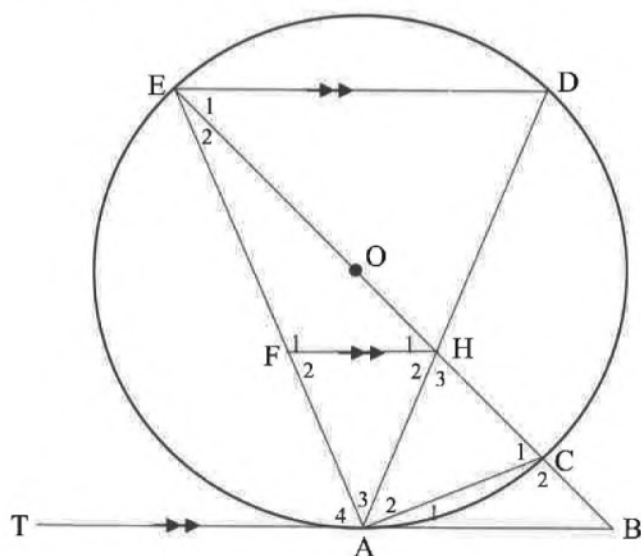
9.1 In  $\triangle ABC$ ,  $DE \parallel BC$ . Prove :

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



(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  $\triangle ABC \sim \triangle EBA$

(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  $\frac{\text{Area of } \triangle AFH}{\text{Area of } \triangle AED}$ .

(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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$40 < t \leq 50$	2	

## QUESTION 6.1

