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NATIONAL SENIOR CERTIFICATE EXAMINATION
SUPPLEMENTARY EXAMINATION – MARCH 2016

MATHEMATICS: PAPER II

EXAMINATION NUMBER

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Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 28 pages and an Information Sheet of 2 pages (i – ii). Please check that your paper is complete.
2. Read the questions carefully.
3. **Answer ALL the questions on the question paper and hand it in at the end of the examination. Remember to write your examination number on the paper.**
4. Diagrams are not necessarily drawn to scale.
5. You may use an approved non-programmable and non-graphical calculator, unless stated otherwise.
6. Round off your answers to **one decimal digit** where necessary, unless stated otherwise.
7. All necessary working details must be clearly shown.
8. Ensure that your calculator is in **DEGREE** mode.
9. It is in your own interest to write legibly and to present your work neatly.

FOR OFFICE USE ONLY: MARKER TO ENTER MARKS

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
18	10	9	18	12	9	13	11	10	10	10	14	6

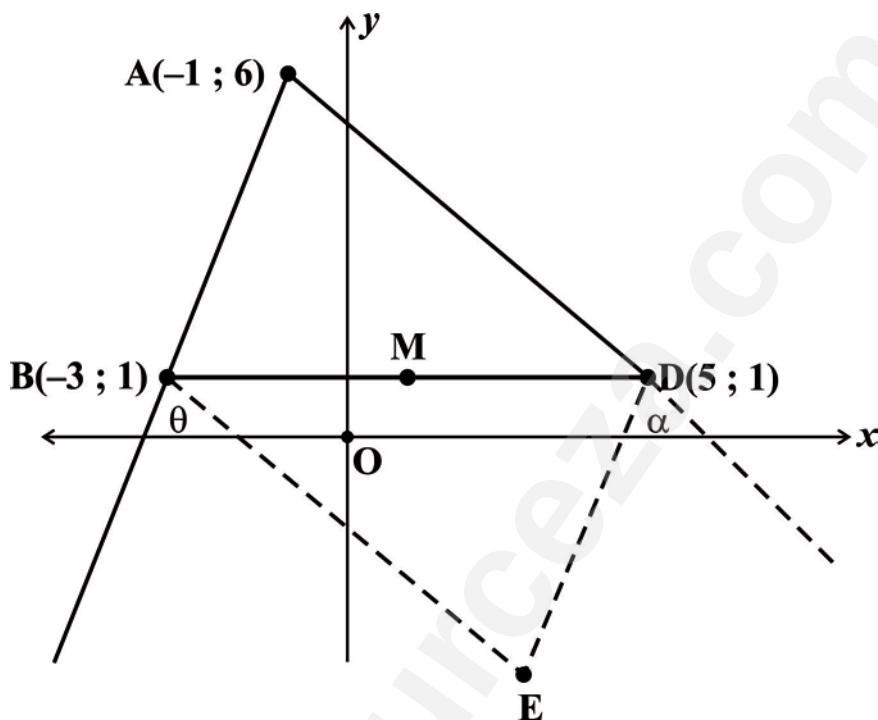
TOTAL	/150
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SECTION A

QUESTION 1

In the diagram, $A(-1; 6)$, $B(-3; 1)$, and $D(5; 1)$ are given.

θ and α are the acute angles that lines AB and AD make respectively with the x -axis.



- (a) Calculate the length of AB to one decimal digit.

(2)

- (b) Determine the coordinates of M , the midpoint of BD .

(2)

- (c) Determine the gradients of AB and AD.

(3)

- (d) Determine θ , α and hence $\hat{A}$. Round off each of these angles to the nearest degree.

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(5)

- (e) If ABED is a parallelogram, determine the co-ordinates of E.

(4)

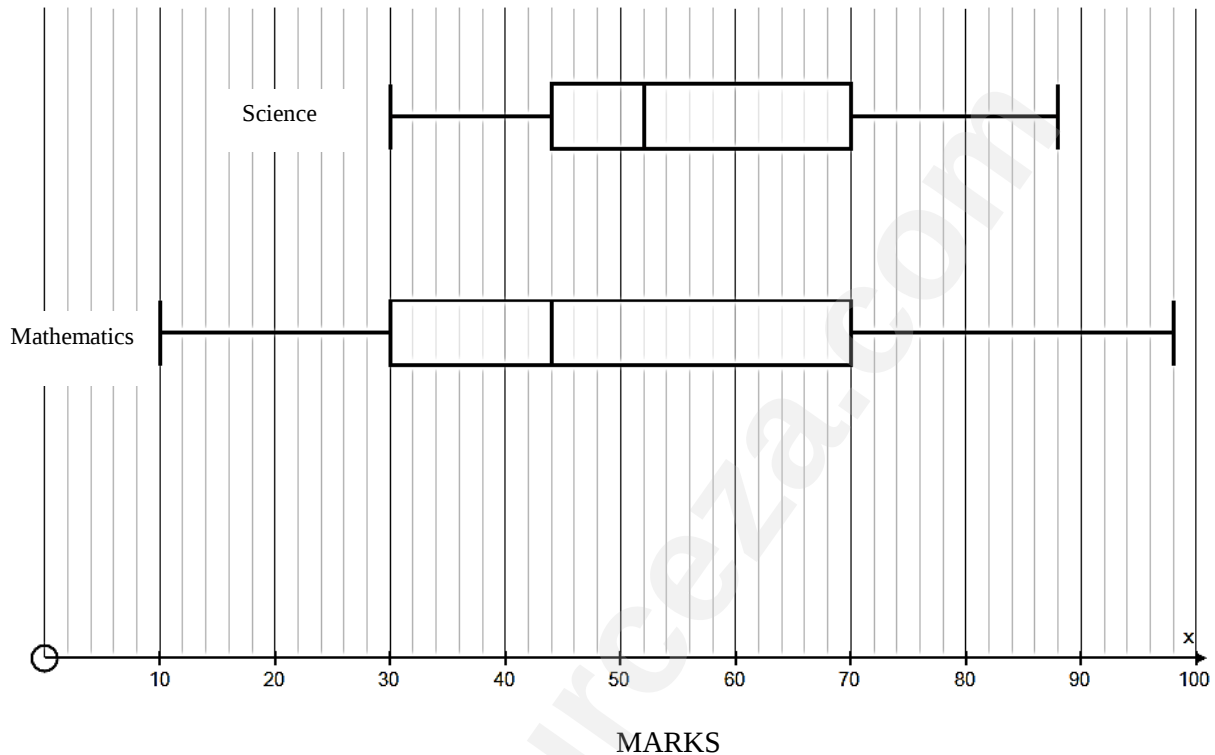
- (f) If C is the point $(-5; -4)$, show that A, B and C lie on the same straight line.

(2)

[18]

QUESTION 2

The box and whisker plots below show the distribution of test scores obtained by a sample of students in Science and Mathematics.



(a) Use the diagram to determine:

(1) The range for Mathematics.

(2)

(2) The median for Science.

(1)

- (3) The interquartile range for Science.

(2)

- (b) Which examination was easier for the students? Justify giving two reasons.

(2)

- (c) Which examination has a wider spread of scores? Justify giving two reasons.

(2)

- (d) If a learner from the Science sample is selected at random, find the probability that they achieved a mark greater than 70%.

(1)

[10]

QUESTION 3

The table shows the number of practice examples (x) completed by learners A to J and the scores (as percentages) obtained (y) in the test.

Learner	A	B	C	D	E	F	G	H	I	J
x	18	5	21	33	60	4	45	28	11	38
y	70	45	90	75	95	60	89	70	49	78

- (a) Determine the least squares regression line in the form $y = a + bx$. Give your values for a and b to 4 decimal places.

(3)

- (b) Use your answer to (a) to extrapolate the score that a learner would obtain if they practised 100 examples. Give your answer to the nearest whole number.

(2)

- (c) Comment on the answer in (b).

(1)

- (d) Calculate the correlation coefficient of the data to the nearest whole number and describe it.

(3)

[9]

QUESTION 4

- (a) Given $\tan \theta = \frac{\sqrt{3}}{2}$ and $\cos \theta < 0$. Without the use of a calculator, express each of the following in its simplest form:

(1) $\sin \theta$ and $\cos \theta$

(2)

(2) $\sin 2\theta$

(2)

(3) $\cos^2(90^\circ + \theta)$

(2)

(b) Simplify fully.

$$\frac{\tan(180^\circ - \theta) \cdot \cos(-\theta) \cdot \sin 390^\circ}{(\cos 300^\circ \cdot \sin \theta) - \cos 450^\circ}$$

(5)

(c) If $\cos A + \sin A = k$, express the following in terms of k :

$$(1) \quad \cos (A-45^{\circ})$$

(4)

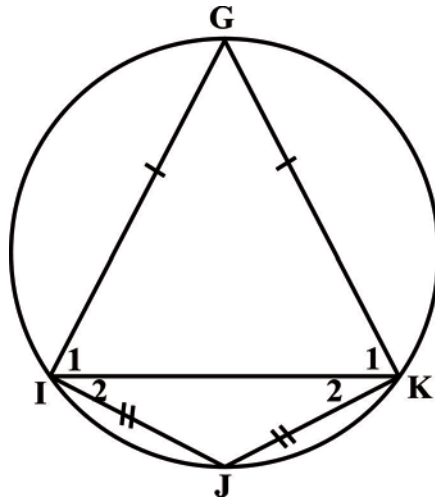
(2) $1 + \sin 2A$

(3)
[18]

-

[illegible]

- (b) In the diagram G, I, J and K lie on the circumference of the circle. $GI = GK$ and $IJ = JK$.



Let $\hat{I}_1 = x$ and $\hat{I}_2 = y$.

Prove that GJ is a diameter of the circle.

This image shows a blank sheet of white paper with horizontal blue ruling lines. A large, light gray watermark with the word "eduresource" is oriented diagonally from the bottom-left towards the top-right across the center of the page. The watermark is semi-transparent, allowing the lines underneath to be visible. There are approximately 20 horizontal lines spaced evenly down the page.

(6)
[12]

$$\hat{O}_2, \hat{L}_2, \hat{L}_1, \hat{Q}_1, \hat{N}$$
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(9)
[9]

76 marks

SECTION B**QUESTION 7**

Given the equation of a circle: $x^2 + y^2 - 4x + 2y + 4 = 0$.

- (a) (1) Show that $\left(\frac{7}{5}; -\frac{9}{5}\right)$ is a point on this circle.

(2)

- (2) Find the equation of the tangent to the circle at the point $\left(\frac{7}{5}; -\frac{9}{5}\right)$.

(8)

- (b) Decide whether the point $(2; -1)$ lies inside, on, or outside the circle having equation $(x-4)^2 + (y+3)^2 = 8$.

Figure Source: <http://www.ck12.org>

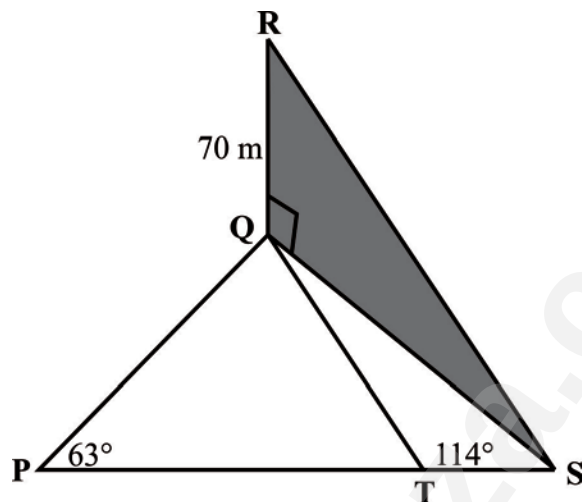
(3)
[13]

(8)

- (b) Determine the height of the vertical pillar PQ to one decimal digit given that Q is a point on the arc.

(3)

[11]



- (a) Show that $QT = 103$ metres rounded to the nearest whole number.

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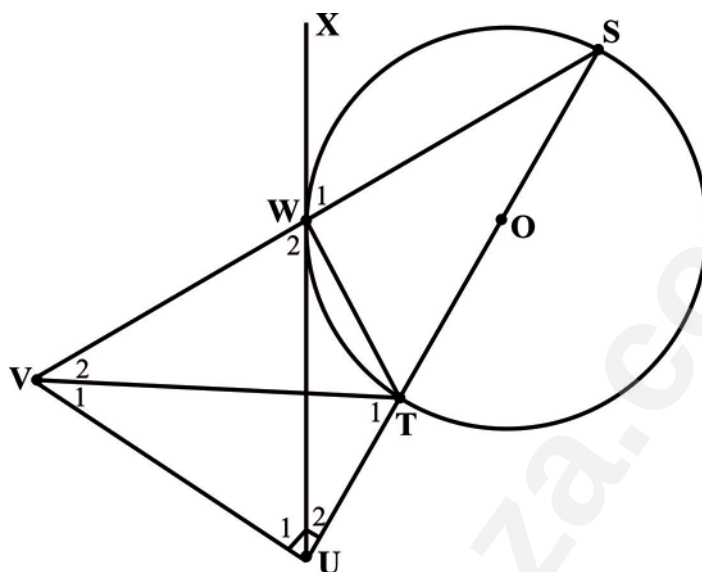
- (b) Determine the angle of elevation of R from S. Round off your final answer to the nearest whole number.

[illegible]

(6)
[10]

QUESTION 11

In the diagram, O is the centre of the circle with diameter ST produced to U. XU is a tangent to the circle at point W and chord SW is produced to V. $VU \perp US$.



- (a) Prove that WVUT is a cyclic quadrilateral.

(4)

- (b) Prove that VU is a tangent to the circle passing through V, T and S.

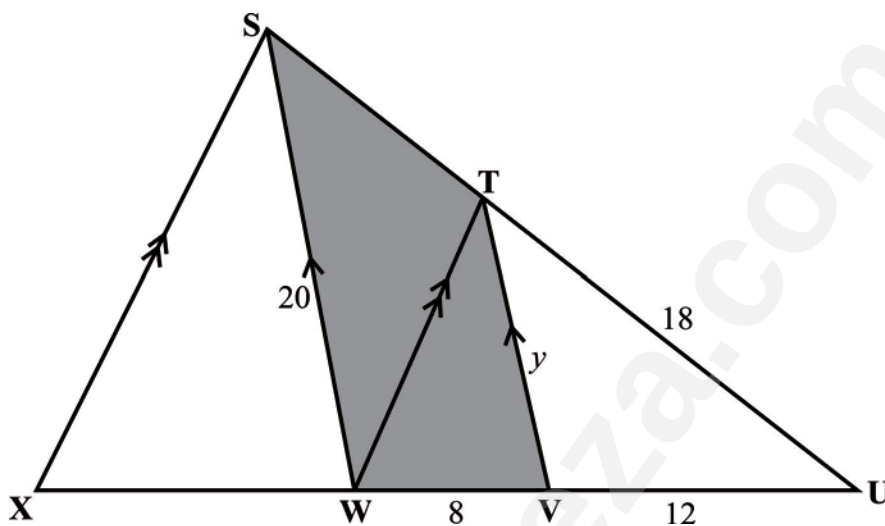
(6)
[10]

QUESTION 12

In the diagram, T is a point of side SU of $\triangle SXU$.

$TW \parallel SX$ and $TV \parallel SW$ with W and V on XU.

$UT = 18$, $UV = 12$, $VW = 8$ and $SW = 20$.



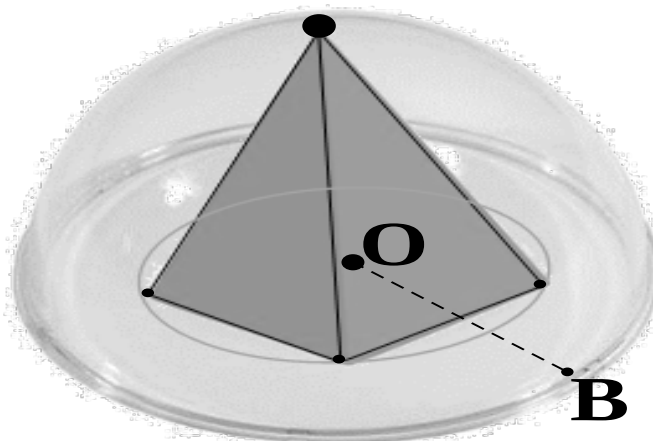
- (a) Determine XW.

(6)

(b) Determine Area ΔSXU .

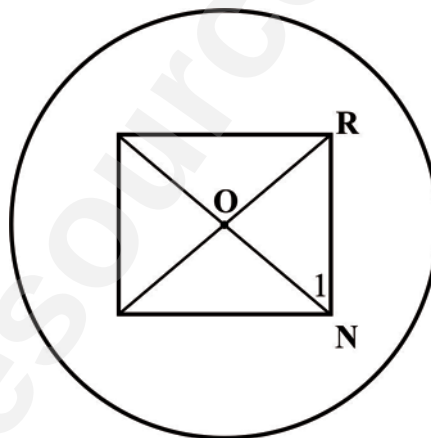
(8)
[14]

QUESTION 13



The diagram represents an aquarium in the shape of a hemispherical dome having radius 25 metres. Within the dome is a solid right pyramid with a rectangular base. The centre O of the rectangle is also the centre of the hemisphere.

- (a) The top view of the hemispherical dome is represented in the diagram below.
 $ON = p$ units and $\hat{N}_1 = \alpha$.



Show that $RN = 2p \cos \alpha$.

(3)

- (b) If the pyramid has a square base and $p = 10$ metres, determine, to the nearest whole number, the volume of water required to completely fill the aquarium.

(Volume of a sphere = $\frac{4}{3}\pi r^3$, volume of a pyramid = $\frac{1}{3}$ area of base $\times$ height)

[illegible]

(3)
[6]

74 marks

Total: 150 marks