

N Levels Practice Paper 2017

MATHEMATICS

4045/02

Paper 2

2 hours

Question Booklet

Additional Material: Writing paper (6 sheets),
Graph paper (1 sheet),
Cover page (1 sheet)

READ THESE INSTRUCTIONS FIRST

Do not open the booklet until you are told to do so.

You are not required to submit this booklet at the end of the paper.

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen on both side of the paper.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of a scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is **60**.

Mathematical Formulae*Compound Interest*

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

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

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Section A (52 marks)Answer **all** questions in this section.

- 1** The population of China in 2016 was approximately 1.4 billion.
- (a) Express 1.4 billion in standard form. [1]
- (b) The land area of China is approximately 9.56 million square kilometres. Estimate the number of people per square kilometre in China. [2]
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- 2*** A train travels from Town P to Town R passing through Town Q . The distance between Town P and Town R is 160 km. The train travels x km at an average speed of 45 km/h from Town P to Town Q .
- (a) Write down an expression, in terms of x , for the time taken, in hours, to travel this first part of the journey. [1]

After travelling for x km to Town Q , the train stops for 40 min. Following that, the train continues the remaining journey to Town R at an average speed of 50 km/h.

- (b) Given that the total time taken for the whole journey is 4 hours, form an equation in x and solve the equation. [3]
- (c) Find the distance travelled from Town Q to Town R . [1]
-

- 3*** (a) Solve $2x - 5 \leq 4\frac{1}{2}$ and hence, state the largest possible integer value of x . [2]
- (b) Simplify $\frac{5x+10}{2x+1} \div \frac{x+2}{2x^2-5x-3}$. [2]
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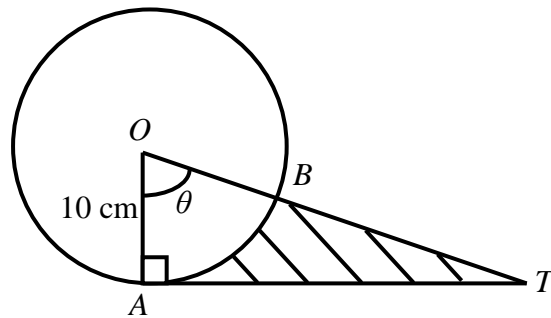
4* (a) Simplify $\frac{(\sqrt{x})^3 \times 2x^2}{2x^0}$. [2]

(b) Given that $\frac{b}{2} = \frac{3b+ac}{a}$, express a in terms of b and c . [3]

(c) Solve the simultaneous equations [3]

$$\begin{aligned} 6x + y - 5 &= 0, \\ 8x + 3y &= -5. \end{aligned}$$

5* The figure below shows a circle with centre O and radius 10 cm. The tangent to the circle at the point A meets OB produced at T .



If the area of the minor sector OAB is 61 cm^2 , find

(a) the angle θ in **radians**, [2]

(b) the **major** arc length AB , [2]

(c) the length of AT , [2]

(d) the area of the **shaded** region. [2]

- 6 A solid sphere has a radius of 12 cm. Calculate
- (a) the total surface area of the sphere, [2]
- (b) the volume of the sphere. [2]

The sphere is now melted down to form a cube.

- (c) Find, correct to the nearest centimetre, the length of one edge of the cube. [1]
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- 7 Mr Lee bought a brand new car. The cash price of the car was \$150 000. Mr Lee paid 20% of the \$150 000 in cash and took a 8-year loan for the remaining amount. The bank charges 2.9% of simple interest per annum.

Calculate

- (a) the amount Mr Lee paid in cash, [1]
- (b) the total interest payable, [2]
- (c) the monthly instalment payable, [2]
- (d) the total cost of the car. [1]
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8* Answer the whole of this question on a single sheet of graph paper.

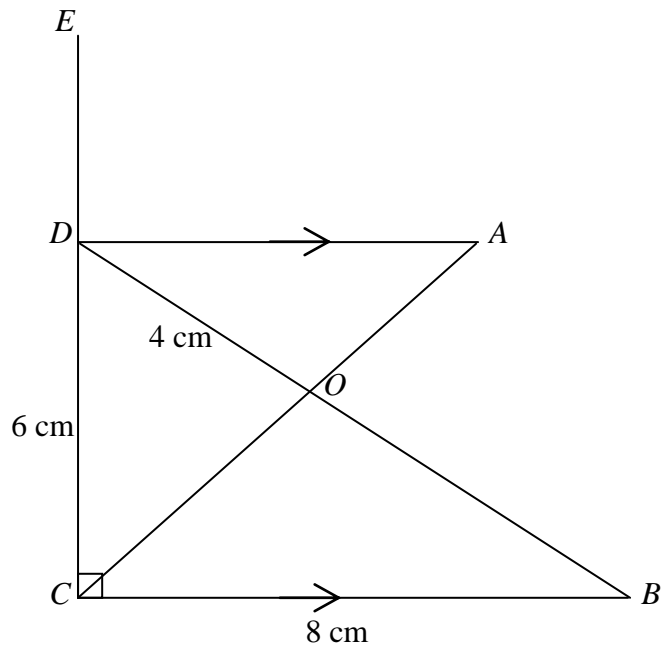
The variables x and y are connected by the equation $y = x^2 - 4x + 1$.

The table below gives some values of x and the corresponding values of y .

x	-2	-1	0	1	2	3	4	5	6
y	13	p	1	-2	q	-2	1	6	13

- (a) Find the value of p and of q . [2]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-2 \leq x \leq 6$. Using a scale of 1 cm to represent 1 unit, draw a vertical y -axis for $-3 \leq y \leq 13$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (c) By **drawing a tangent**, find the gradient of the curve at the point where $x = 3$. [2]
- (d) Write down the equation of the line of symmetry of the curve. [1]

- 9 In the diagram, AD is parallel to BC . CDE , BOD and AOC are straight lines.



Give a reason why

- (a) angle $AOD =$ angle BOC , [1]
 (b) angle $BCD =$ angle ADE . [1]

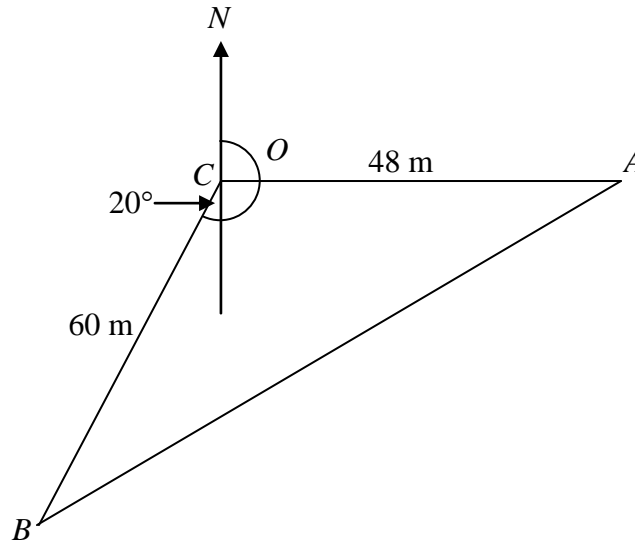
Triangles AOD and COB are similar. Given that angle $BCD = 90^\circ$, $CD = 6$ cm, $BC = 8$ cm and $OD = 4$ cm, calculate

- (c) the length of BD , [1]
 (d) the length of AD . [2]
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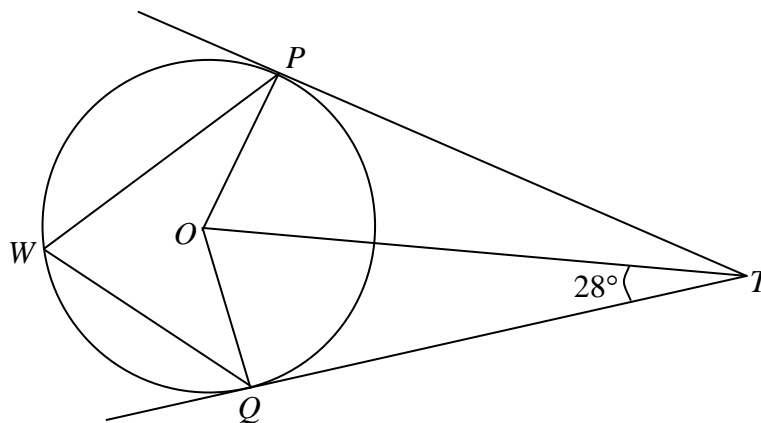
Section B (8 marks)

Answer only **one** question from this section.

- 10*** (a) There are 3 houses, A , B and C on a horizontal field. House A is due East of House C . House B is at a bearing of 200° from House C . The distance of House A to House C is 48 m while the distance of House C to House B is 60 m.



- (i) Find angle BCA . [1]
- (ii) Calculate the distance between House A and House B . [2]
- (iii) Given that the height of House C is 8 m and the height of House A is 12 m, find the angle of elevation of the roof of House A from the roof of House C . [2]
- (b) In the diagram, the points P , Q and W lie on a circle with centre O . T is an external point where TP and TQ are tangents to the circle and angle OTQ is 28° .



- Calculate
- (i) angle POQ , [2]
- (ii) angle PWQ . [1]
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- 11*** (a) The test scores of 40 students in class A are given in the distribution table.

Score	1–10	11–20	21–30	31–40	41–50
No. of Students	2	8	11	10	9

Calculate

- (i) the mean score for class A, [2]
- (ii) the standard deviation for class A. [2]

The mean score for class B in the same test is 25 marks while the standard deviation for class B is 9.

- (iii) Which class, A or B performed better for the test?
Give a reason why. [1]

- (b) Billy either walks or takes the bus to school every morning. The probability that he walks to school on any particular morning is $\frac{1}{3}$. When he walks to school, the probability that he is late is $\frac{2}{5}$. When he takes the bus to school, the probability that he is late is $\frac{1}{10}$. Find the probability that on a particular morning,

- (i) Billy takes the bus and is not late, [1]
- (ii) Billy is late. [2]