Name

Reg. No | Class

4E/5N

MATHEMATICS **4052/01**

Paper 1 [90 marks]

PRELIMINARY EXAMINATION

23 August 2023

2 hours 15 minutes

Candidates answer on the Question Paper

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.
Write your name, Index number and class on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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

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 total of the marks for this paper is **90**.

The use of an approved 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.

Write the brand and model of your calculator in the space provided below.

Brand/Model of Calculator

For Examiner's Use	
Total	90

This question paper consists of **18** printed pages.

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

Answer all the questions

1 Calculate $\sqrt[5]{\frac{13.8^2}{1-0.038}}$. Write your answer correct to the nearest whole number.

Answer ..... [1]

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2 Simplify.

(a) $3x-5(x-1)$

Answer ..... [1]

(b) $12x^2y \div 3xy^{-5}$

Answer ..... [1]

---

3 A car has an average petrol consumption of 0.0955 kilometres per litre.
Find the petrol consumption in litres per kilometre.

Answer ..... l / km [1]

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4 (a) Express 0.00588 in standard form.

Answer ..... [1]

(b) Convert 0.00588 m^3 to cm^3.

Answer ..... cm^3 [1]

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5 Solve $\frac{x}{6}-\frac{2x-1}{4}=1$.

Answer $x =$ ..... [2]

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6 Ali has 504 one-centimetre cubes. He arranges all the cubes into a cuboid.
If the base area of the cuboid is a square, find the smallest possible height of the cuboid.

Answer .....cm [2]

---

7 The marked price of a computer in a shop is \$ m.
During the National Day Sale, it was sold at a discount of d %.

(a) Express the selling price as a single fraction in terms of m and d.

Answer \$ ..... [1]

(b) The shopkeeper made a profit of 20% from the sale of the computer.
Express the cost price as a single fraction in terms of m and d.

Answer \$ ..... [1]

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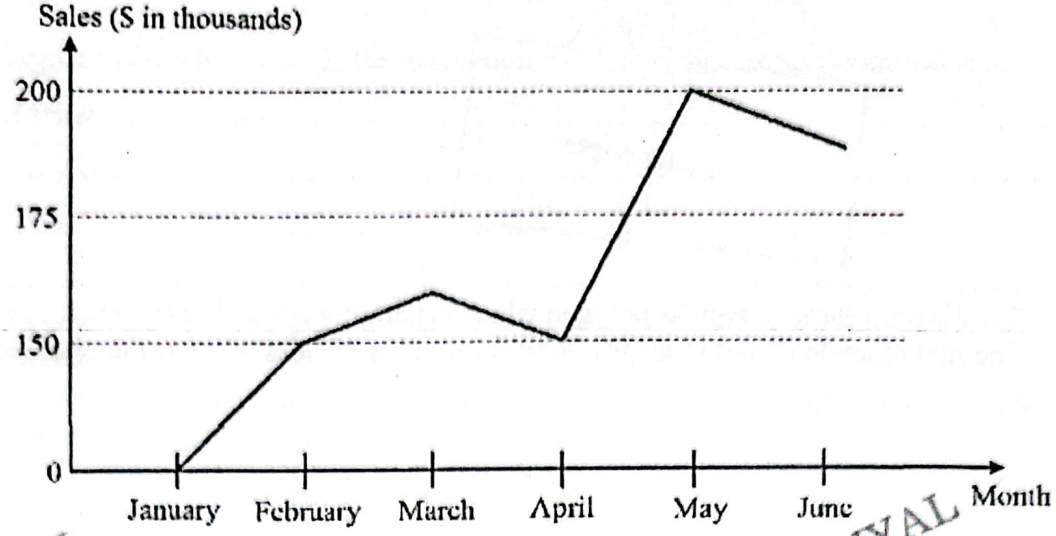
8 The graph shows the monthly sales of a newly opened shop from January to June in 2023.



(a) State one misleading feature of the graph.

Answer .....

..... [1]

(b) Explain how this feature affects the reader's interpretation of the graph.

Answer .....

.....

.....

.....

..... [1]

---

9 Written as a product of its prime factors, $20=2^2\times 5$.

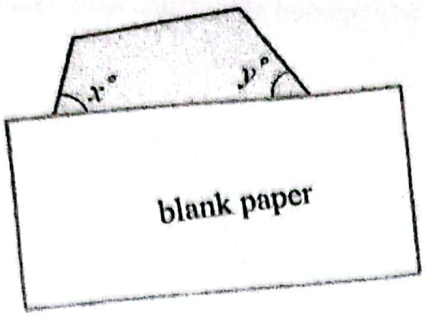
(a) Write 240 as a product of its prime factors.

Answer ..... [1]

(b) The highest common factor (HCF) of two numbers is 20.
The lowest common multiple (LCM) of two numbers is 240.
Both numbers are greater than 50. Find the two numbers.

Answer ..... , ... [2]

10



The diagram shows a regular polygon which is partially covered with a sheet of blank paper. The sum of angle $x°$ and $y°$ is 60°. Find the number of sides of the regular polygon.

Answer ..... [3]

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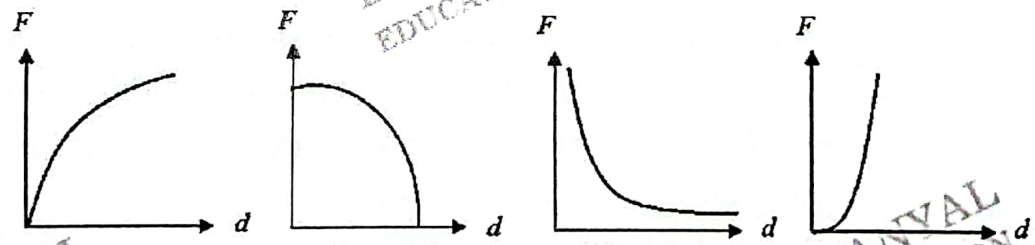
11 The force, F, between two objects, is inversely proportional to the square of the distance, d, between them.

(a) Which of these diagrams represents the graph of F against d?



Answer Diagram ..... [1]

(b) The distance between two objects is increased by 150%.
Calculate the percentage reduction in the force between the objects.

Answer .....% [3]

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12 The expression $5-4x-x^2$ can be written as $-(x+2)^2+9$.

(a) Explain why when $x=-2$, the expression $5-4x-x^2$ has its maximum value.

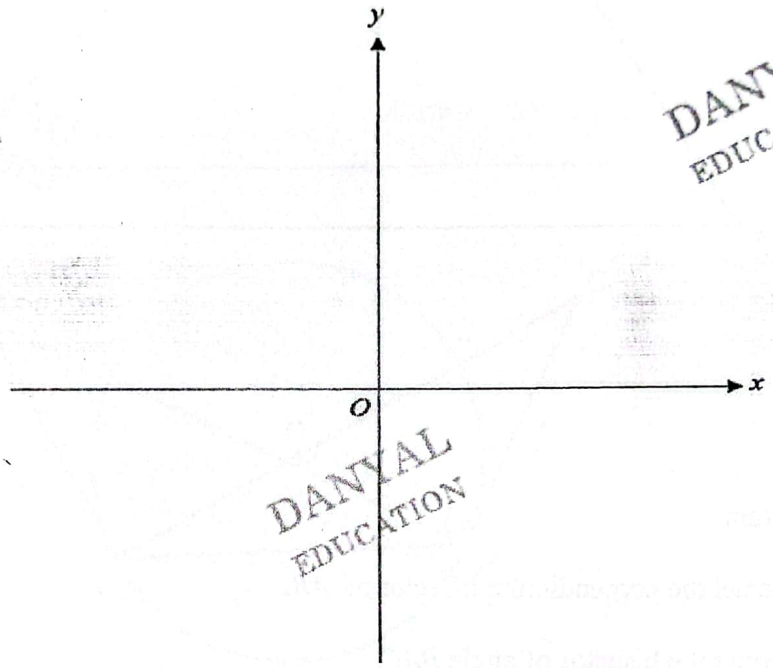
Answer .....

.....

.....

..... [1]

(b) **Sketch** the graph of $y=5-4x-x^2$ on the axis below.
Indicate clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve. [3]



13 Factorise completely.

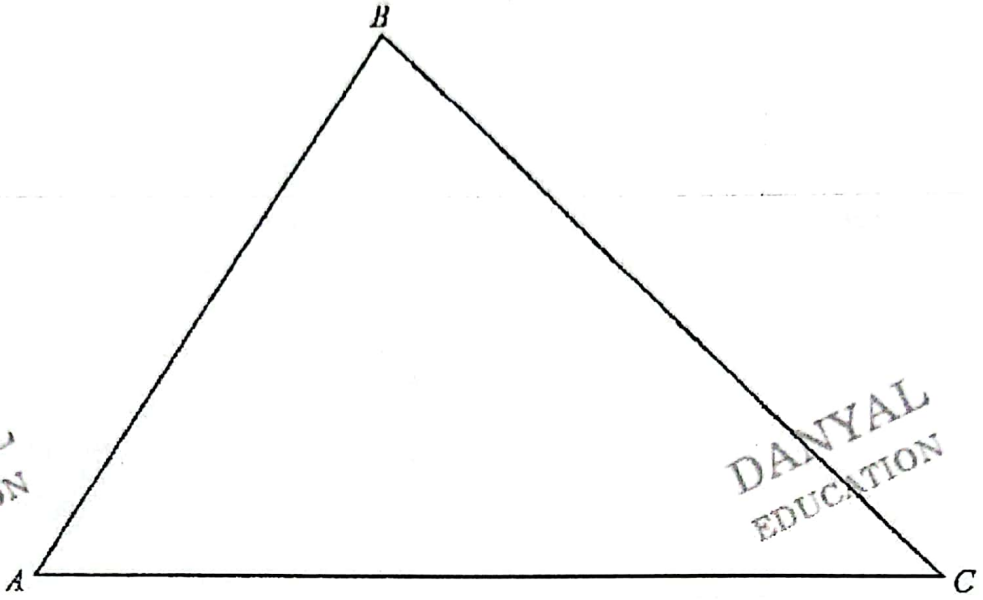
(a) $4b+12ab-3a-1$

Answer ..... [2]

(b) $a^2+2ax+x^2-4b^2$

Answer ..... [2]

14 The diagram shows a triangle ABC.



On the diagram,

(a) Construct the perpendicular bisector of AB. [1]

(b) Construct the bisector of angle BAC. [1]

(c) The two bisectors intersect at the point P.
Complete the statement below.

Answer

The point P is equidistant from the points ..... and .....

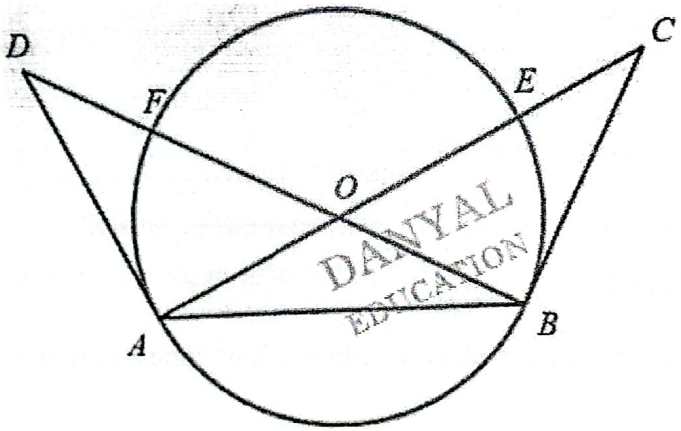
and equidistant from the lines ..... and ..... [1]

15 Given $\left(\frac{81}{9^n}\right)^{-1} = \sqrt{3^m}$.

Find an expression for m in terms of n.

Answer $m =$ ..... [3]

16



In the diagram, AD and BC are tangents to the circle, centre O, at the points A and B respectively. $AOEC$ and $BOFD$ are straight lines.

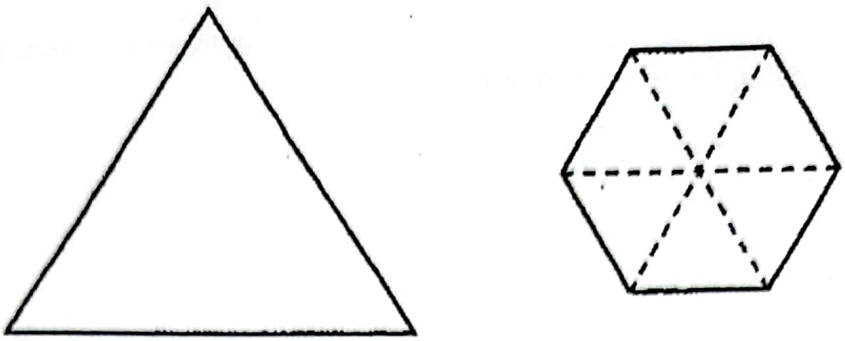
Show that triangle OAD and triangle OBC are congruent.

Give a reason for each statement you make.

Answer

[3]

17



The diagram shows an equilateral triangle and a regular hexagon.
The ratio of the perimeters triangle : hexagon = 3 : 2
Find the ratio of the areas triangle : hexagon .

Answer ..... : ..... [2]

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18 Cone A has a volume of 400 cm³.

(a) Calculate the volume of cone B with base radius half of cone A and height 5 times of cone A.

Answer .....cm³ [2]

(b) Calculate the volume of cone C that is similar to cone A but has a curved surface area that is $\frac{1}{9}$ of cone A.

Answer .....cm³ [2]

---

19 Ali can paint 7 fence panels in 5 hours.
Cindy can paint 6 fence panels in 4 hours.
Ali and Cindy work together to paint a total of 17 panels.
If they continue to paint at the same rate, how long will it take them to paint the 17 panels ?
Give your answer in hours and minutes, to the nearest minute.

Answer .....hours .....minutes [3]

---

20 Here are the first five terms of a sequence.

$$\frac{1}{2} \quad \frac{4}{4} \quad \frac{7}{6} \quad \frac{10}{8} \quad \frac{13}{10}$$

(a) Find the sixth term of the sequence .

Answer ..... [1]

(b) T_n is the nth term of the sequence.
Find an expression, in terms of n, for T_n.

Answer $T_n =$ ..... [2]

(c) The difference, D, between two consecutive terms of the sequence is $T_{n+1} - T_n$.
Show that $D = \dfrac{1}{n(n+1)}$.

Answer

[3]

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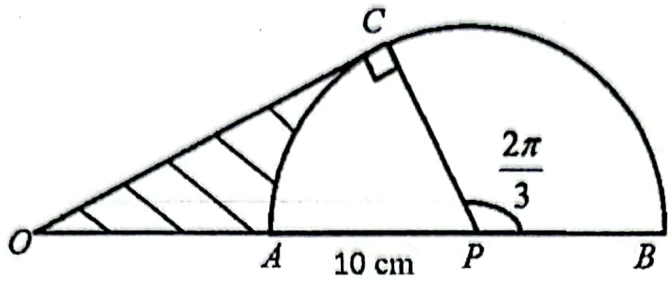
21 The figure shows a semicircle ABC with centre P and radius 10 cm.
OC is a tangent to the circle at C and meets BA produced at O.

Angle $CPB = \frac{2\pi}{3}$ radians.



(a) Find the length OC.

Answer .....cm [2]

(b) Find the area of the shaded region COA.

Answer .....cm² [3]

22 (a) $\xi = \{ \text{integers } x : 15 < x < 30 \}$
$A = \{ \text{prime numbers} \}$
$B = \{ \text{multiples of 3} \}$
$C = \{ \text{factors of 30} \}$

List the elements in

(i) A,

Answer ..... [1]

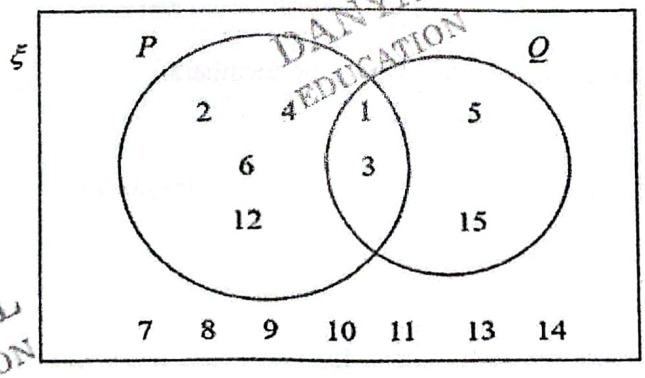
(ii) $(A \cup B)'$.

Answer ..... [1]

(iii) Explain why C is an empty set.

Answer .....
..... [1]

(b) The Venn diagram shows the elements of $\xi = \{ \text{integers } x : 1 \leq x \leq 15 \}$.



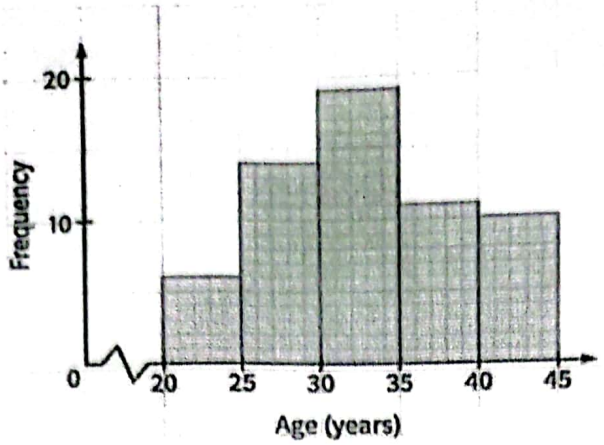
(i) Describe the elements in set P.

Answer .....
..... [1]

(ii) Find the value of $n[(P \cap Q') \cup (P' \cap Q)]$.

Answer ..... [1]

23



The histogram shows the distribution of the ages of 60 members in a club.

(a) Which interval contains the median age?

Answer ..... [1]

(b) Find the estimated mean age of the members.

Answer ..... [1]

(c) Find the estimated standard deviation of the members.

Answer ..... [1]

(d) The members in the club remain unchanged after 5 years.

(i) Write down the new mean age of the members.

Answer ..... [1]

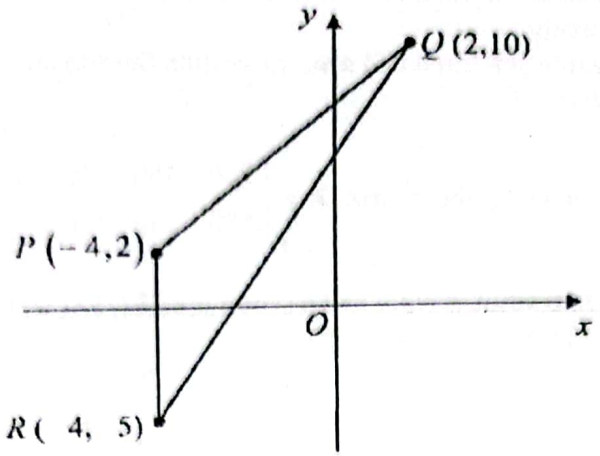
(ii) Without calculating, explain why the standard deviation remains unchanged.

Answer .....

.....

..... [1]

24 The diagram shows three points $P(-4,2)$, $Q(2,10)$ and $R(-4,-5)$.



(a) Find the length of PQ.

Answer .....units [1]

(b) Express as a fraction in its lowest term, find $\cos \angle QPR$.

Answer ..... [1]

(c) Find the area of triangle PQR.

Answer .....units² [1]

(d) The line $mx+2y+3=0$ has the same gradient as line RQ.
Find the value of m.

Answer ..... [3]

25 A zoo is open every day in a week.
The average number of adults, children and seniors visiting the zoo on a weekday is 200, 350 and 150 respectively.
The average number of adults, children and seniors visiting the zoo on a weekend is 500, 750 and 180 respectively.

The information is represented by the matrix $\mathbf{Z} = \begin{pmatrix} 200 & 350 & 150 \\ 500 & 750 & 180 \end{pmatrix}$.

(a) The ticket price for an adult, a child and a senior are \$32, \$21 and \$14 respectively.
Represent the price by a 3×1 matrix **P**.

Answer **P** = ... [1]

(b) Find the matrix $\mathbf{T} = \mathbf{ZP}$.

Answer **T** = ... [2]

(c) State what the elements of **T** represent.

Answer .....
.....
..... [1]

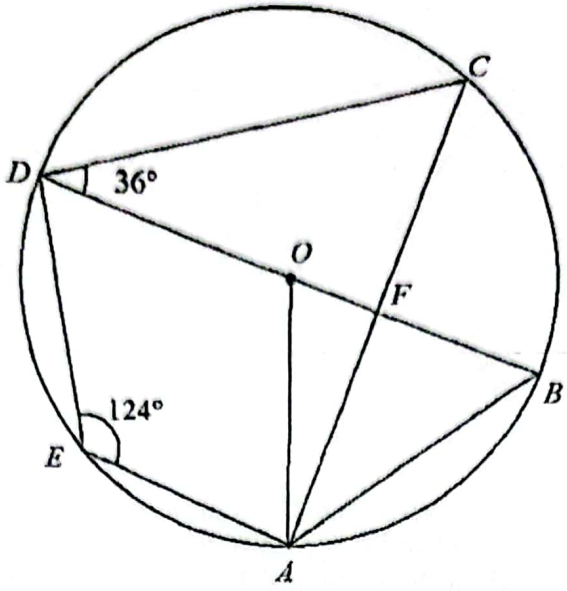
(d) There are 5 weekdays and 2 weekends.
Write down a matrix **D** such that **DT** represent the total revenue of the zoo in a week.

Answer **D** = ... [1]

(e) Find the matrix **DT**.

Answer **DT** = ... [1]

26 (a)



A, B, C, D and E are points on a circle, centre O.
BD is the diameter of the circle. BD intersects AC at point F.
Angle $AED = 124°$ and angle $BDC = 36°$.

(i) Complete the statement.

Angle CAB = ... because .....
..... [1]

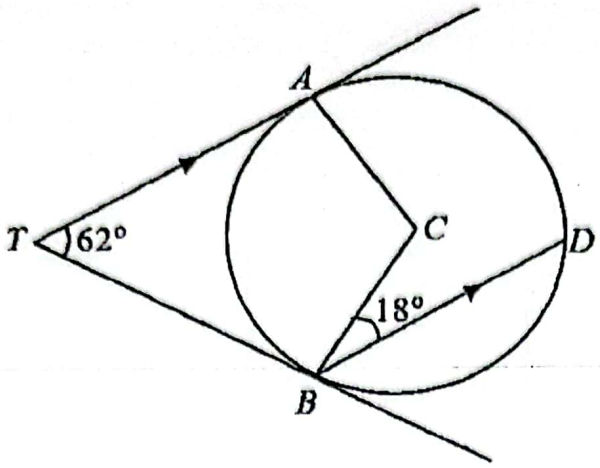
(ii) Complete the statement.

Reflex angle AOD = ...because .....
..... [1]

(iii) Find angle AFB.
Give a reason for each step of your working.

Answer .....° [2]

26 (b)



In the diagram, TA and TB are tangents to the circle at A and B respectively.
D is a point on the circle such that BD is parallel to TA.
C is a point inside the circle such that angle CBD is 18°.
Angle ATB is 62°.

(i) Find angle TAB.
Give a reason of your working.

Answer .....° [1]

(ii) Show that C is not the centre of the circle.

Answer

[2]