TRINITY COLLEGE

Year 11 Specialist Mathematics Unit 1,2
Test 3   2021

Section 1   Calculator Free
Geometry, Proof, Trigonometry

STUDENT'S NAME   _____

DATE: Friday 14 May   **TIME:** 35 minutes   **MARKS**: 35

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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1.   (6 marks)

Consider the true statement: *If a polygon is a quadrilateral then it has four sides*.

(a)   Write down the converse of this statement and state whether it is true or false, and if it is false provide a counter example.   [2]

(b)   Write down the contrapositive of this statement and state whether it is true or false, and if it is false provide a counter example.   [2]

(c)   Write down the inverse of this statement and state whether it is true or false, and if it is false provide a counter example.   [2]

2.   (6 marks)

(a)   In the diagram below, points Q, R and S lie on a circle with centre O, with tangents from P touching the circle at Q and S. If $\angle OSQ = 28°$, determine the size of $\angle QRS$ and $\angle QPS$.   [3]
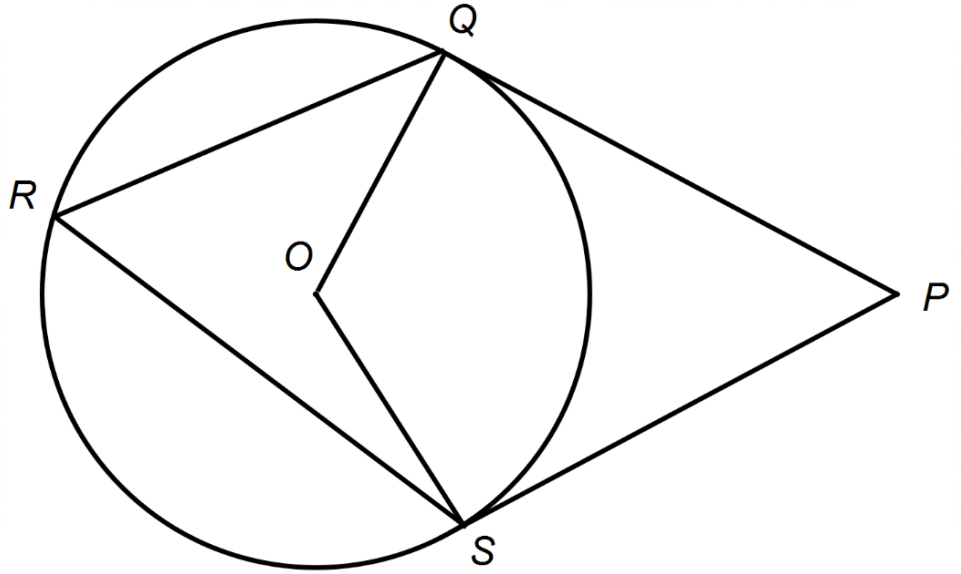
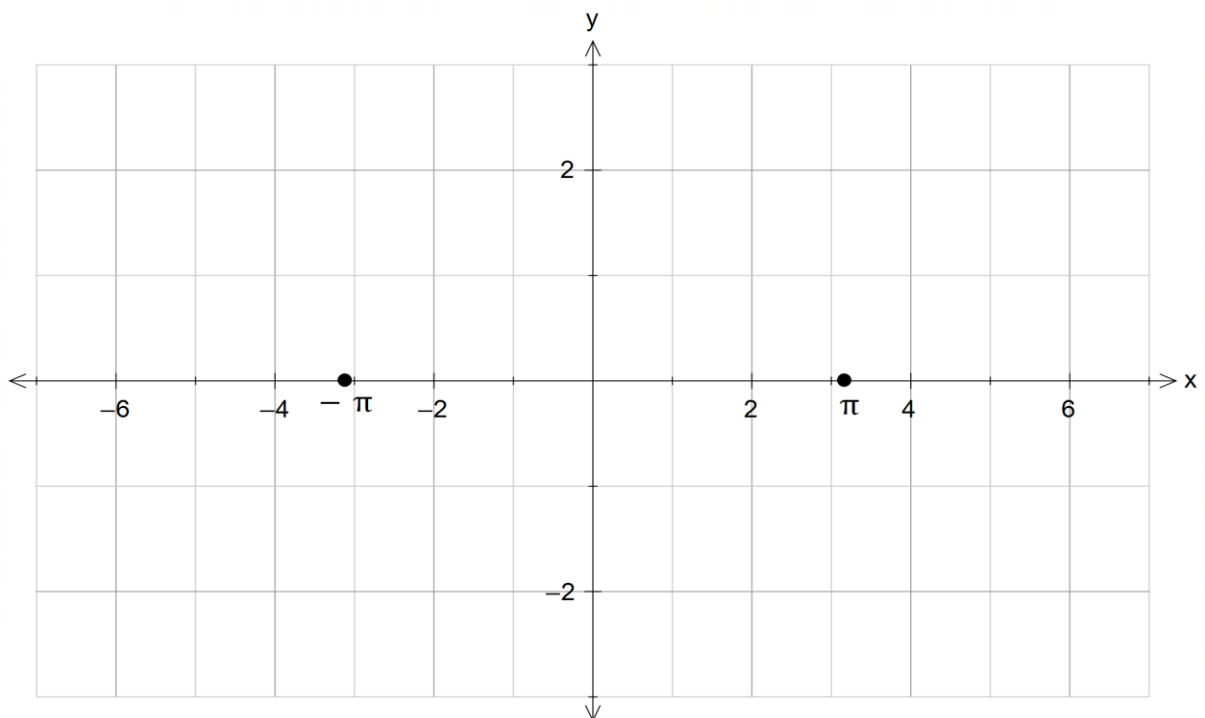(b)   In the diagram below, determine the size of the angles marked *x, y, z.*   [3]
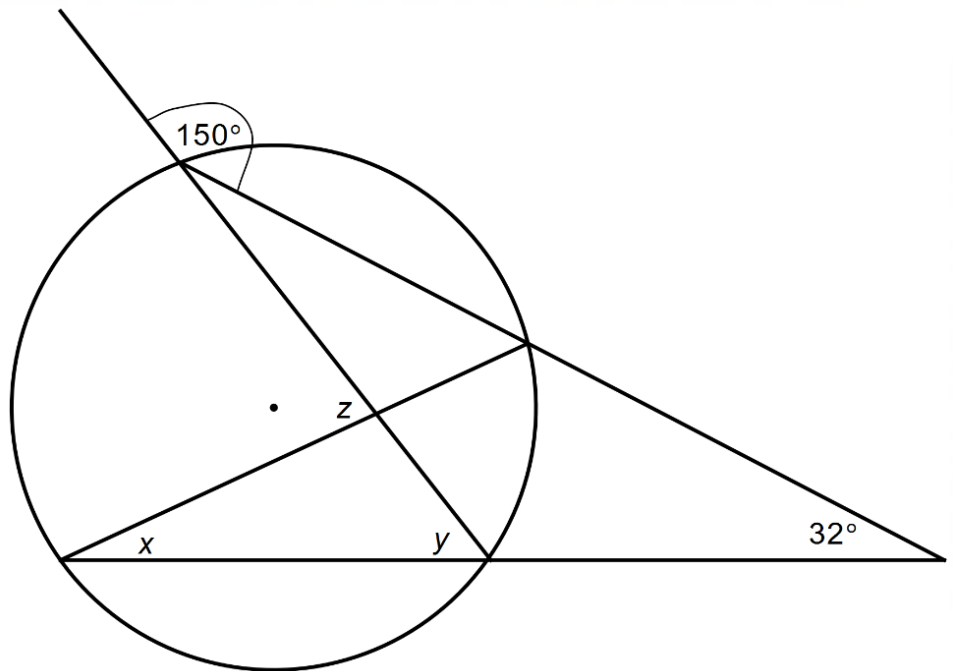
3. (4 marks)

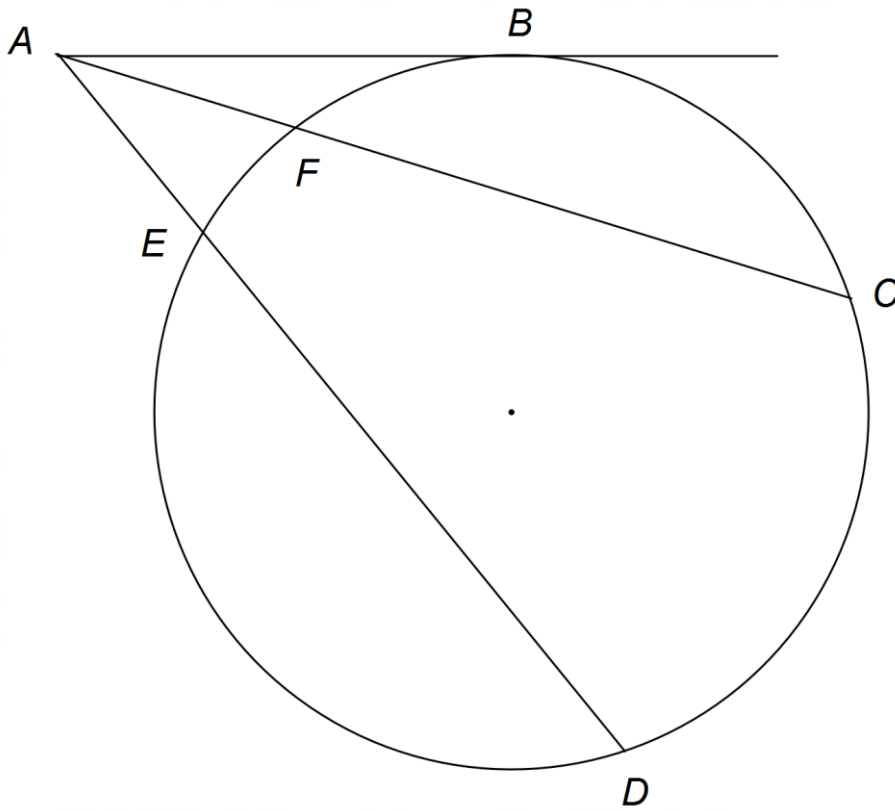Use the method of proof by contradiction to prove $\sqrt{6}$ is irrational.

4. (4 marks)

Sketch the function $y = 2\sin(\dfrac{x}{2} - \dfrac{\pi}{4}) - 1$ on the axes below.

5.   (4 marks)

In the diagram below, points *B, C, D, E* and *F* lie on a circle and *AB* is a tangent to the circle at point *B*. If *AB* = 10 cm, *AF* = 6 cm and *ED* = 8 cm, determine the exact lengths of *FC* and *AE*.

6. (11 marks)

Solve the following equations.

(a) $\sin \vartheta = -0.5$ $\quad -180° \le \vartheta \le 360°$ [3]

(b) $\tan 2\vartheta = \dfrac{1}{\sqrt{3}}$ [4]

(c) $2\cos(\vartheta + \dfrac{\pi}{6}) = \sqrt{3}$ $\quad 0 \le \vartheta \le 2\pi$ [4]

TRINITY ☩ COLLEGE

Year 11 Specialist Mathematics Unit 1,2
Test 3   2021

Section 1   Calculator Assumed
Geometry, Proof, Trigonometry

STUDENT'S NAME _____

DATE: Friday 14 May   **TIME:** 15 minutes   **MARKS**: 18

INSTRUCTIONS:
Standard Items: Pens, pencils, drawing templates, eraser
Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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7.   (7 marks)

In the diagram, *AOB* is the diameter of the circle. *AC* is a chord of the circle and *CD* is perpendicular to the tangent *AD*.
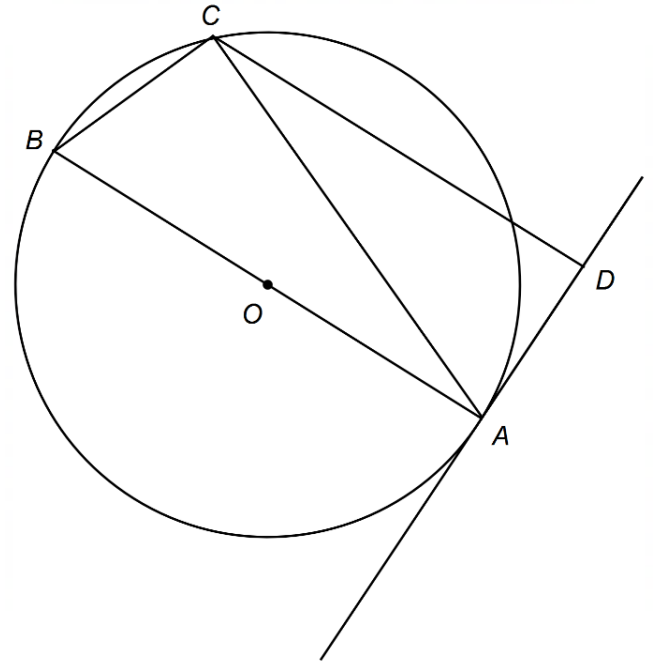
(a)   Prove $\triangle ABC$ is similar to $\triangle CAD$.   [3]

(b)   Hence show $\left(AC\right)^2 = (AB) \times (CD)$ [2]

(c)   Determine the radius of the circle when $AC = 16$ cm and $AD = 11$ cm.   [2]

8.   (8 marks)

The height of the tide above the mean sea level at a certain point has been modelled by the

function $h(t) = 5.6\sin\dfrac{\pi t}{6}$ metres   where t is the number of hours after midnight on a particular

day.

Consider the graph of this function for $0 \le t \le 24$.

(a)   At what time is the first high tide?   [2]

(b)   How much does the tide drop from high tide to low tide?   [1]

(c)   What was the height of the tide at 8.00 pm?   [2]

(d)   A ship needs at least 4.9 m of water above the low tide mark to safely enter the harbour
        in this scenario. Over the 24 hour period, state the times when the ship can safely enter
        the harbour.   [3]

9.   (3 marks)

If a room contains 75 adults, use the pigeonhole principle to explain why there must be at least 11 people who have their birthday on the same day of the week.