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FREE CAPS MATHS RESOURCES

GRADE 11 · EUCLIDEAN GEOMETRY

Circle Geometry Riders: Proofs, Converses & Method (Grade 11)

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
31	50 minutes	3

Name: _____ Class: _____

Date: _____

MARK ____ / 31

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 The line drawn from the centre of a circle perpendicular to a chord ... (1)

A) is equal to the chord
B) is a tangent
C) halves the radius
D) bisects the chord ✓

> **Answer: D** — line from centre ⊥ chord.
> - **A** — its length depends on the radius
> - **B** — a tangent touches the circle at one point only
> - **C** — nothing forces it to be half the radius

1.2 O is the centre and $A\hat{O}B = 140°$. The angle at the circumference subtended by the same arc AB is ... (1)

A) $140°$
B) $280°$
C) $70°$ ✓
D) $40°$

> **Answer: C** — $\angle$ at centre $= 2 \times \angle$ at circumference, so $140° \div 2 = 70°$.
> - **A** — the angle at the circumference is HALF the angle at the centre
> - **B** — doubled instead of halving
> - **D** — that is $180° - 140°$

1.3 In cyclic quadrilateral PQRS, $\hat{P} = 105°$. Then $\hat{R}$ = ... (1)

A) $105°$ **B) $75°$ ✓**

C) $255°$ **D)** $15°$

> **Answer: B** — opp ∠s of cyclic quad: $180° - 105° = 75°$.
> - **A** — opposite angles of a cyclic quad are supplementary, not equal
> - **C** — subtracted from $360°$ instead of $180°$
> - **D** — subtracted from $90°$

1.4 To PROVE that ABCD is cyclic you may use ... (1)

A) a pair of opposite angles that add up to $180°$ ✓ **B)** opp ∠s of a cyclic quad

C) the angle at the centre theorem **D)** a pair of equal chords

> **Answer: A** — The CONVERSE: if opposite angles are supplementary, the quadrilateral is cyclic.
> - **B** — that reason assumes the quadrilateral is already cyclic
> - **C** — a proof of cyclicity has no centre to work from
> - **D** — equal chords do not make a quadrilateral cyclic

1.5 A chord of 24 cm lies in a circle of radius 13 cm. Its distance from the centre is ... (1)

A) 12 cm **B)** 11 cm

C) $\sqrt{313}$ cm **D) 5 cm ✓**

> **Answer: D** — The perpendicular bisects the chord: $\sqrt{13^2 - 12^2} = \sqrt{25} = 5$ cm.
> - **A** — that is half the chord
> - **B** — subtracted $13 - 2$ instead of using Pythagoras
> - **C** — ADDED the squares instead of subtracting

1.6 The angle between a tangent and a chord at the point of contact equals ... (1)

A) the angle at the centre **B)** $90°$

C) the angle in the alternate segment ✓ **D)** the angle in the same segment

> **Answer: C** — tan–chord theorem.
> - **A** — the angle at the centre is twice the angle in the alternate segment
> - **B** — that is the angle between a tangent and a RADIUS
> - **D** — it is the OTHER segment

1.7 PA and PB are tangents from P to a circle with centre O. If $A\hat{P}B = 50°$, then $A\hat{O}B$ = ... (1)

A) $50°$ **B) $130°$ ✓**

C) $100°$ **D)** $25°$

> **Answer: B** — $O\hat{A}P = O\hat{B}P = 90°$ (tan ⊥ radius), so $A\hat{O}B = 360° - 90° - 90° - 50° = 130°$.
> - **A** — the angles of OAPB add up to $360°$, not equal in pairs
> - **C** — doubled the $50°$ as if it were an angle at the circumference
> - **D** — halved the $50°$

1.8 The exterior angle of a cyclic quadrilateral equals ... (1)

A) the interior opposite angle ✓ **B)** the adjacent interior angle

C) $90°$ **D)** twice the opposite angle

> **Answer: A** — ext ∠ of cyclic quad.
> - **B** — those two are supplementary
> - **C** — no right angle is involved
> - **D** — that describes the angle at the centre

1.9 Angles at the circumference subtended by the same arc are ... (1)

A) supplementary **B)** complementary

C) in the ratio $1 : 2$ **D) equal ✓**

> **Answer: D** — ∠s in the same segment.
> - **A** — that is opposite angles of a cyclic quad
> - **B** — no $90°$ relationship is involved
> - **C** — that compares the circumference with the centre

1.10 The FIRST step in proving that the perpendicular from the centre bisects a chord is to ... (1)

A) measure the two halves of the chord **B)** draw a tangent

C) join the centre to both ends of the chord ✓ **D)** assume the chord is bisected

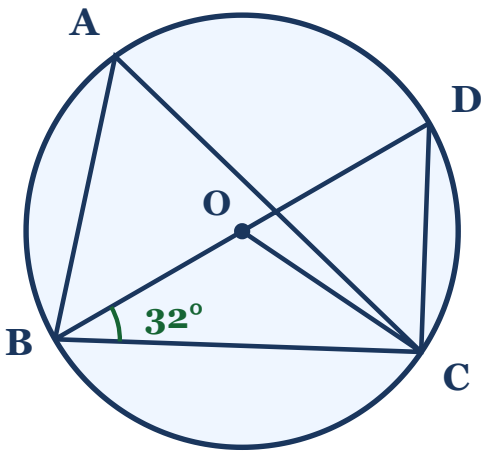
> **Answer: C** — The construction (two radii) sets up the congruent triangles.
> - **A** — measuring is never a proof
> - **B** — no tangent is needed
> - **D** — that assumes the conclusion

ANSWER GRID — MARKING GUIDELINE

1.1	A	B	C	(D)
1.2	A	B	(C)	D
1.3	A	(B)	C	D
1.4	(A)	B	C	D
1.5	A	B	C	(D)
1.6	A	B	(C)	D
1.7	A	(B)	C	D
1.8	(A)	B	C	D
1.9	A	B	C	(D)
1.10	A	B	(C)	D

QUESTION 2 [13 MARKS]

In the diagram below, O is the centre of the circle. A, B, C and D lie on the circle, BD is a diameter and $D\hat{B}C = 32°$. *The diagram is not drawn to scale.*



2.1 Determine, with reasons, the sizes of $B\hat{C}D$ and $B\hat{D}C$. **(4)**

$B\hat{C}D = \mathbf{90°}$ *(1)* (∠ in semicircle) *(1)*
$B\hat{D}C = 180° - 90° - 32° = \mathbf{58°}$ *(1)* (∠s of △) *(1)*

2.2 Determine $B\hat{A}C$, with a reason. **(2)**

$B\hat{A}C = B\hat{D}C = \mathbf{58°}$ *(1)* (∠s in same segment) *(1)*

2.3 Determine $B\hat{O}C$, with a reason. **(3)**

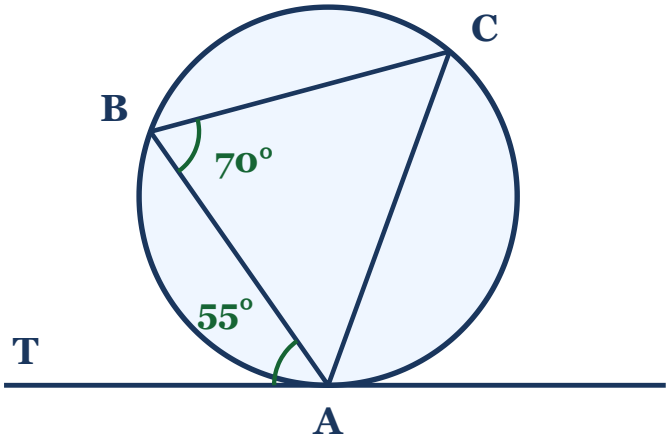
$B\hat{O}C = 2 \times B\hat{D}C$ *(1)* $= \mathbf{116°}$ *(1)* (∠ at centre = 2 × ∠ at circumference) *(1)*

2.4 Explain why △OBC is isosceles, and hence calculate $O\hat{B}C$. **(4)**

OB = OC (radii) *(1)*, so △OBC is isosceles *(1)*
$O\hat{B}C = \frac{180° - 116°}{2}$ *(1)* $= \mathbf{32°}$ *(1)* — as it must be, because O lies on BD

QUESTION 3 [8 MARKS]

In the diagram below, TA is a tangent to the circle at A. B and C lie on the circle, $\hat{TAB} = 55°$ and $\hat{ABC} = 70°$.



3.1 Determine $\hat{ACB}$, with a reason. **(2)**

$\hat{ACB} = \hat{TAB} = \mathbf{55°}$ *(1)* (tan–chord theorem) *(1)*

3.2 Determine $\hat{BAC}$, with a reason. **(3)**

$\hat{BAC} = 180° - 70° - 55°$ *(1)* $= \mathbf{55°}$ *(1)* (∠s of △) *(1)*

3.3 Prove that AB = BC. **(3)**

$\hat{BAC} = \hat{ACB} = 55°$ *(1)*
sides opposite equal angles are equal *(1)*
$\therefore$ AB = BC *(1)*

TOTAL: 31 marks

This question paper consists of 3 questions.

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