Province of the
EASTERN CAPE
EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2019

TECHNICAL MATHEMATICS P2

MARKS: **150**

TIME: **3 hours**

ITMATE2

This question paper consists of 11 pages.

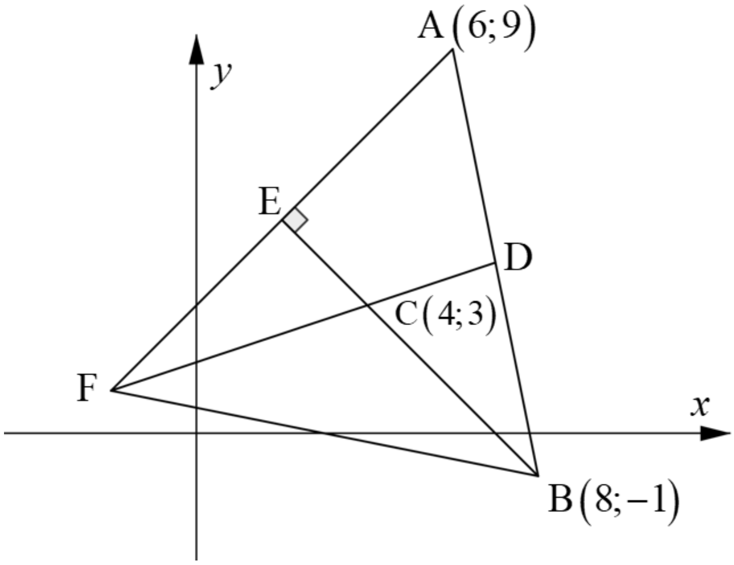
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.
6. If necessary, round off your answers to TWO decimal places, unless stated otherwise.
7. Diagrams are not necessarily drawn to scale.
8. Write neatly and legibly.

QUESTION 1

In the diagram below, A(6; 9) and B(8; -1) and F are three points on a Cartesian plane.
D is the midpoint of AB.
$BE \perp AF$, with E a point on AF.
BE intersects DF at point C(4; 3).



1.1	Calculate the coordinates of D.	(2)
1.2	Determine the equation of FD.	(5)
1.3	Calculate the gradient of BE.	(2)
1.4	Determine the equation of AF	(3)
1.5	Determine the coordinates of F.	(4)
1.6	Calculate the size of $A\hat{B}E$ (rounded off to ONE decimal digit).	(6)

[22]

QUESTION 2

2.1 Given: $3\cot\theta = -2$, $\theta \in [180°; 360°]$

Determine, without using a calculator:

2.1.1 $\cos(180° + \theta)$ (5)

2.1.2 $9\ \text{cosec}^2\ \theta + 4\sec^2\theta$ (4)

2.2 Simplify the following expression:

$$\frac{\cos(180° + \theta).\tan(360° - \theta).\cos^2(360° + \theta)}{\sin(180° - \theta)} + \sin^2\theta$$ (6)

2.3 If $\sin 50° = t$, determine the following in terms of *t*:

2.3.1 $\cos 50°$ (2)

2.3.2 $\tan 230°$ (3)

2.4 Solve for *x*:

$2\tan(x + 10°) = -3{,}46$ and $x \in [0°; 360°]$ (5)

[25]

QUESTION 3

Given: $f(x) = 2\cos x$ and $g(x) = \sin(x + 30°)$ for $x \in [0°; 360°]$

3.1 Draw neat sketch graphs of the functions on the same system of axes using the provided grid in the SPECIAL ANSWER BOOK.

Clearly show ALL critical points. (6)

3.2 Read off from the graphs values of *x* where $f(x) = g(x)$? (2)

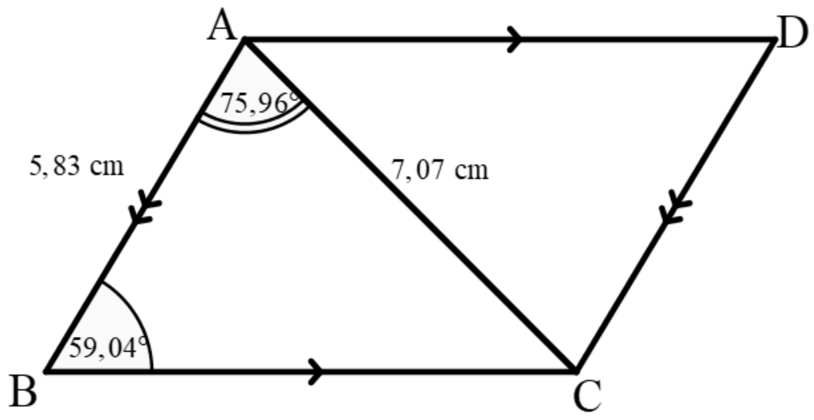
3.3 Use the graphs to determine $2\cos x.\sin(x + 30°) \geq 0$ for $x \in [0°; 300°]$ (4)

3.4 For which values of *x* does $\sin(x + 30°)$ increase in value as *x* increases in value? (4)

[16]

QUESTION 4

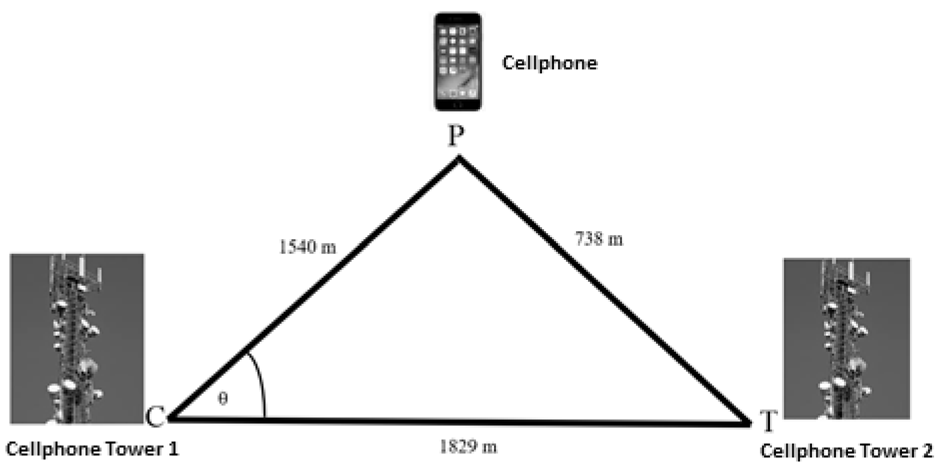
4.1 In the diagram below, ABCD is parallelogram with AB equal to 5,83 cm and diagonal AC is 7,07 cm. $A\hat{B}C = 59{,}04°$ and $B\hat{A}C = 75{,}96°$.



4.1.1 Calculate the length of BC. (3)

4.1.2 Determine the area of ABCD. (5)

4.2 In the diagram below, two cellphone towers are 1 829 m apart. A cellphone picks up their signals. The cellphone from Tower One is 1 540 m away and Tower Two is 783 m away.

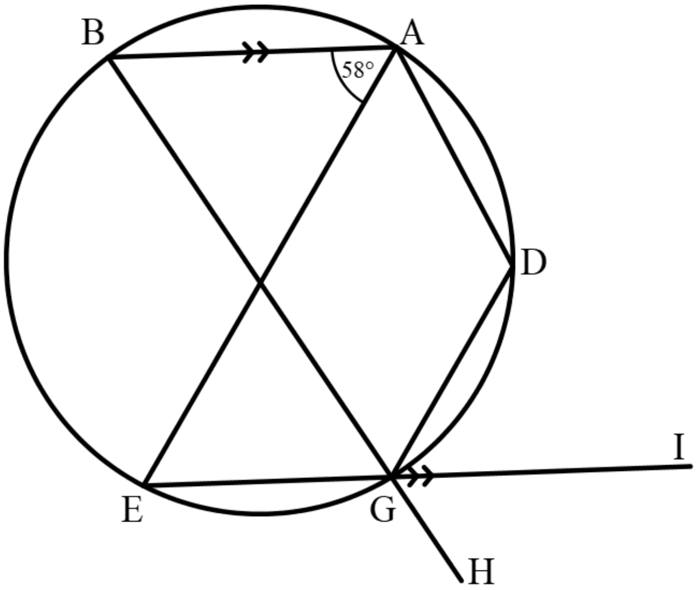


Determine the angle, θ, which Tower One makes with the cellphone (correct to ONE decimal digit). (4)

[12]

QUESTION 5

5.1 In the diagram below, circle ABEGD is given with AB ∥ EG, $B\hat{A}E = 58°$ and AE bisect $B\hat{A}D$.



Determine, with reasons:

5.1.1 $A\hat{E}G$ (1)

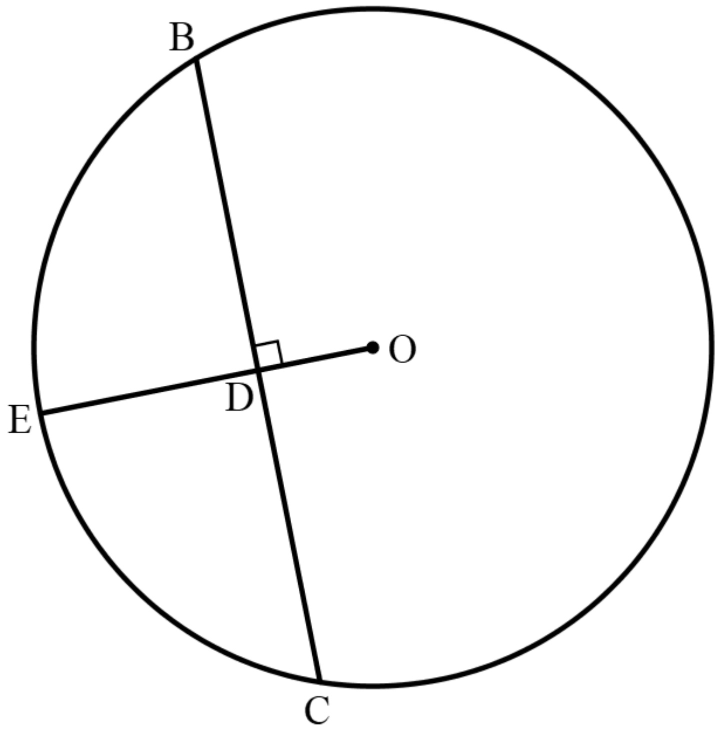
5.1.2 $D\hat{G}H$ (3)

5.1.3 Show that $D\hat{G}I = I\hat{G}H$ (4)

5.1.4 Show that AE ∥ DG. (2)

5.1.5 $A\hat{D}G$ (2)

5.2 In the diagram below, a chord BC of circle with centre O is 12 cm. $OE \perp BC$ and OE intersect with BC at D.

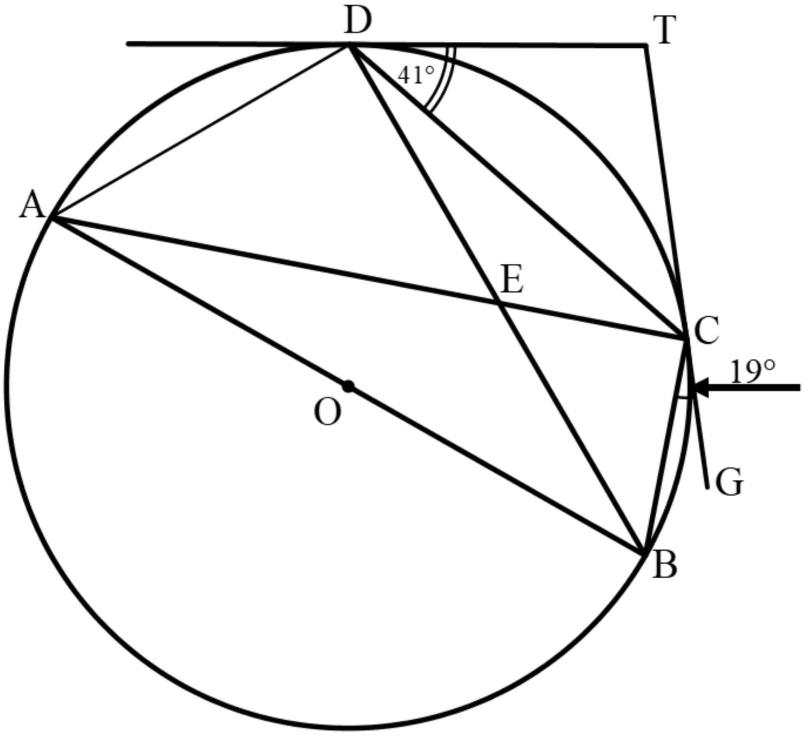


If ED = 2DO, calculate the length of the radius of the circle. (6)

[18]

QUESTION 6

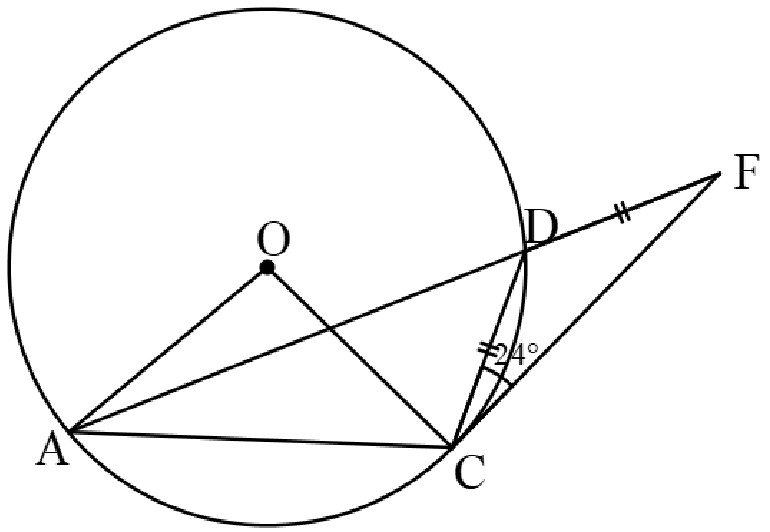
6.1 In the diagram below, ABCD is a cyclic quadrilateral with AB the diameter of the circle. DT and TG are tangents to the circle with $T\hat{D}C = 41°$ and $B\hat{C}G = 19°$. AC and DB are drawn to intersect at E.



6.1.1 Name, with reasons, THREE other angles equal to 41°. (5)

6.1.2 Determine, with reasons, the size of $A\hat{B}E$. (4)

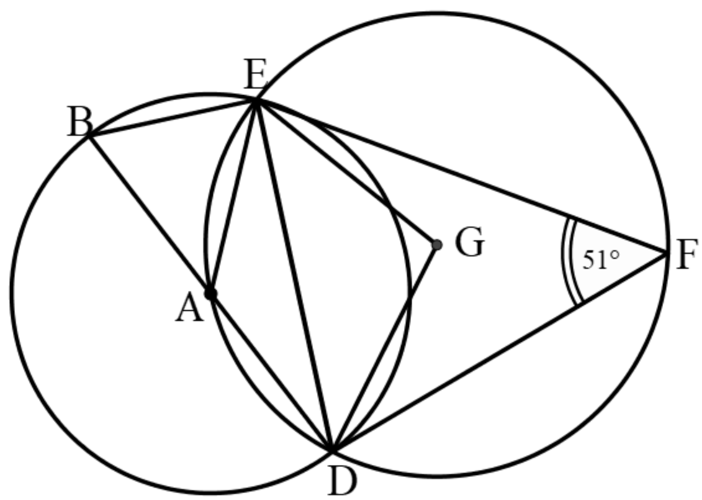
6.2 In the diagram below, ACD is a circle with centre O. CD = DF and $D\hat{C}F = 24°$.



6.2.1 Determine, with reasons, the size of $A\hat{O}C$. (4)

6.2.2 If CF is a tangent to the circle, prove that AC = CF, with reasons. (2)

6.3 In the diagram below, two circles BDE and EADF intersect at E and D.
A is the centre of circle BDE and G is the centre of circle EADF.
BAD is a straight line.
$\hat{F} = 51°$



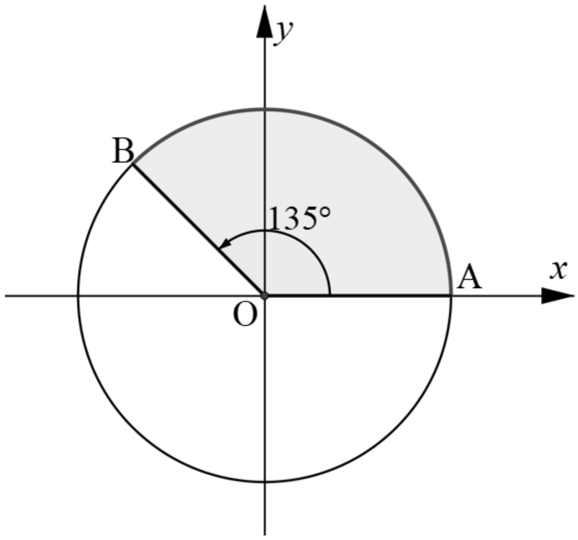
6.3.1 Determine, with reasons, the size of $\hat{B}$. (5)

6.3.2 Show, with reasons, whether EBDG is a cyclic quadrilateral. (3)

[23]

QUESTION 7

7.1 The diagram below, shows sector AOB with a subtended angle of $135°$. The area of the sector is 18,85 cm^2.



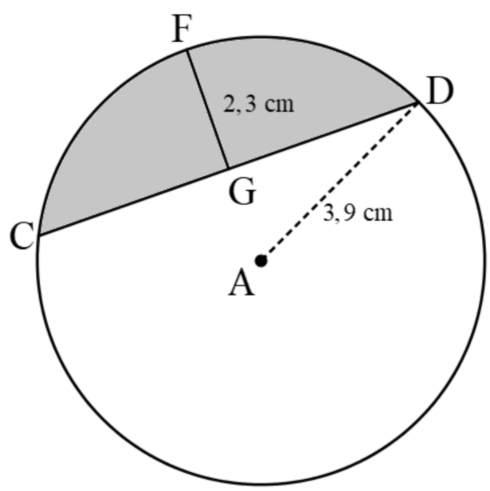
7.1.1 Convert the angle to radians. (2)

7.1.2 Determine the radius of the circle, to the nearest integer. (5)

7.1.3 Determine the equation of the circle. (1)

7.1.4 Determine the arc length AB. (3)

7.2 In the diagram below, A is the centre of the circle with radius 3,9 cm. The height of the smaller segment is FG = 2,3 cm.

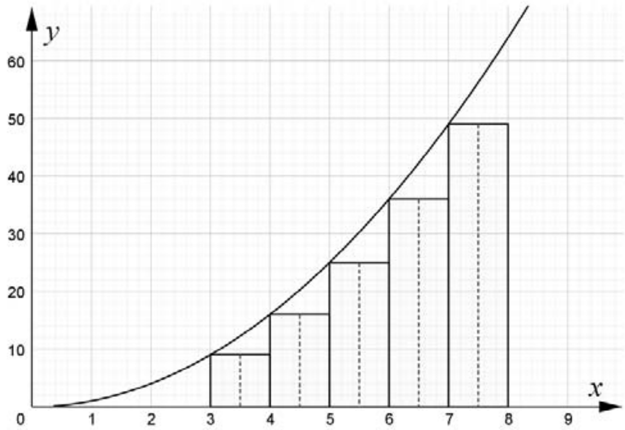


Determine the length of the chord CD, to ONE decimal digit. (4)

[15]

QUESTION 8

8.1 The area under a parabola for the interval $x \in [3;8]$ is 161,7 square units.
Approximate this same area using the mid-ordinate rule with 5 strips as depicted in the table and diagram below.



8.1.1 Complete the table:

x	3,5	4,5	5,5	6,5	7,5
$f(x)$	12,25				

(2)

8.1.2 Hence, use the mid-ordinate rule to approximate the area. (4)

8.1.3. Determine the difference in error. (1)

8.2 A wheel, with a diameter of 38,5 cm turns at 42 revolutions per minute.

Calculate:

8.2.1 The angular velocity of the wheel in radians per second (4)

8.2.2 The circumferential velocity in metres per second (4)

8.3 A rectangular lead prism with dimensions 43 cm × 22 cm × 8 cm is melted. The melted fluid is cast as smaller metal spheres, all of the same size.

$\text{Area} = 2lh + 2bh + 2bl$	$\text{Volume} = lbh$
$\text{Area} = 2\pi r^2 + 2\pi rh$	$\text{Volume} = \pi r^2 h$
$\text{Area} = \pi r^2 + \pi rl$ $= \pi r^2 + \pi r\sqrt{h^2 + r^2}$	$\text{Volume} = \frac{1}{3}\pi r^2 h$
$\text{Area} = 4\pi r^2$	$\text{Volume} = \frac{4}{3}\pi r^3$

If the diameter of one sphere is 3 cm, calculate how many small spheres can be cast. (4)
[19]

TOTAL: 150