Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2019

MATHEMATICS P2 (EXEMPLAR)

MARKS: 150

TIME: 3 hours

This question paper consists of 14 pages.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your 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 answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly.

QUESTION 1

A **kilocalorie** is a unit of energy. For example, if food contains 20 **kilocalories**, it's a way of describing how much energy your body could get from eating the food.

The list below shows the energy quantities, in **kilocalories** per 100 g, of 10 different snack bars.

440; 520; 480; 560; 615

550; 620; 680; 540; 490

1.1 Calculate the mean kilocalories per 100 g bar. (2)

1.2 Calculate the standard deviation of kilocalories per 100 g bar. (1)

1.3 Draw a box and whisker diagram in the ANSWER BOOK using the given energy quantities. (5)

1.4 Describe the skewness of the distribution of energy quantities. (2)

1.5 10 different **breakfast cereals** promoting energy levels of kilocalories per 100 g were chosen. The mean energy level of the breakfast cereals was 545,7 kilocalories and the standard deviation of the energy levels of the breakfast cereals was 28 kilocalories.

Which food type, snack bars or breakfast cereals, have the greater variety in energy levels? Explain your answer. (3)

[13]

QUESTION 2

Port Elizabeth is considered to be the 'windy' city of South Africa.
The table below shows the frequency of wind speeds measured at midday at Port Elizabeth International Airport during the month of October 2018.

Wind Speed (km/hr)	Frequency	Cumulative Frequency
$10 < x \leq 12$	1	1
$12 < x \leq 14$	2	3
$14 < x \leq 16$		6
$16 < x \leq 18$	4	10
$18 < x \leq 20$	7	
$20 < x \leq 22$	7	24
$22 < x \leq 24$	4	28
$24 < x \leq 26$		30
$26 < x \leq 28$	1	

2.1 Complete the table in your answer book. (2)

2.2 Draw an ogive graph on the grid in your answer book. (3)

2.3 Use your graph to determine:

2.3.1 The median wind speed (2)

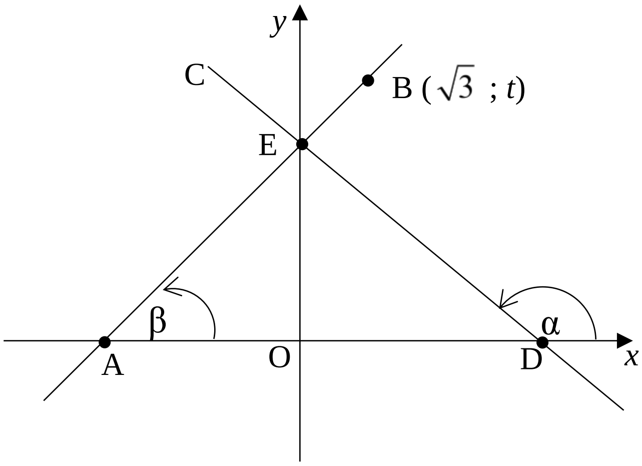
2.3.2 The number of days the wind speed exceeded 23 km/hr (2)

[9]

QUESTION 3

In the diagram below, line AB makes an angle of β with the *x*-axis, and line CD makes an angle of α with the *x*-axis. A and D are points on the *x*-axis. The coordinates of B are $\left(\sqrt{3};t\right)$ AB and CD intersect at E, a point on the *y*-axis and $A\hat{E}D = 63,69^{o}$.

The equation of CD is $3x + 2y = 6$.



3.1 Determine the coordinates of E. (2)

3.2 Determine the gradient of CD. (2)

3.3 Calculate the value of α . (2)

3.4 Hence, determine the value of β . (1)

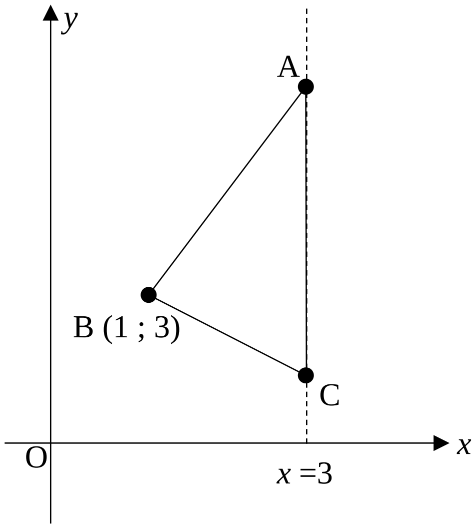
3.5 Determine the equation of AB in the form $y = mx + c$. (3)

3.6 Calculate the value of t . (2)

3.7 Determine the area of ΔABD. (5)
[17]

QUESTION 4

The diagram below shows a ΔABC with $\hat{B} = 90^o$ and the coordinates of B (1 ; 3). A and C lie on the line $x = 3$. The length of AB is $2\sqrt{5}$ units and the length of AC is 5 units.



4.1 Determine the coordinates of A. (4)

4.2 Give the coordinates of C. (2)

4.3 Show that the mid-point of AC is (3 ; 4,5). (2)

4.4 Determine the coordinates of D(a ; b) so that ABCD is a parallelogram. (3)

4.5 ABCD is reflected in the line $x = 5$ and moved 3 units down to A' B' C' D'.
Write down the coordinates of B'. (2)

[13]

QUESTION 5

DO NOT USE A CALCULATOR FOR THIS QUESTION.

5.1 Given $\cos\theta = -\frac{1}{3}$ and $0° \leq \theta \leq 180°$

Determine, with the aid of a diagram, the value of the following

5.1.1 $\tan(180° + \theta)$ (3)

5.1.2 $3\sin(\theta - 90°)$ (2)

5.2 Given: $\frac{\sin(-210°)}{\cos(300°)} + \frac{\cos(x + 90°)}{\sin(360° + x)}$

5.2.1 Simplify the following expression: $\frac{\sin(-210°)}{\cos(300°)} + \frac{\cos(x + 90°)}{\sin(360° + x)}$ (5)

5.2.2 For which values of x is the expression in 5.2.1 undefined for $-360^{o} \leq x \leq 360^{o}$? (2)

5.3 Prove that $\tan\theta\sqrt{\frac{1}{\sin^2\theta} - 1} = 1$ (4)

5.4 Determine the general solution of the following equation:

$2\sin^2\theta = 1 + \sin\theta$ (6)

[22]

QUESTION 6

6.1 On the grid provided in the answer book, draw the graphs of $f(x) = -2\cos x$ and $g(x) = \sin 2x$, for the interval $-90^\circ \leq x \leq 180^\circ$, on the same axes.
Show the coordinates of the intercepts on the axes and the turning points of the graphs. (6)

6.2 Use your graph to find the value(s) of x where:

6.2.1 $g(x) - f(x) = 2$ (1)

6.2.2 $f(x) \leq g(x)$ (2)

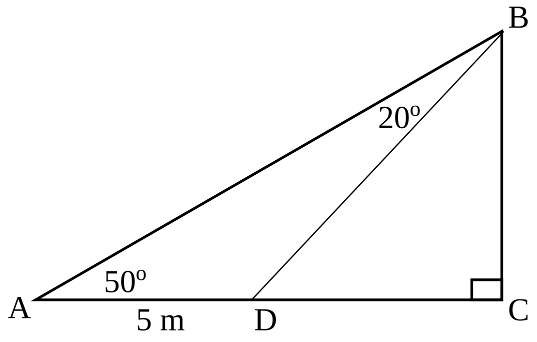
6.2.3 $f(x)$ and $g(x)$ are both increasing (2)

6.3 If $f(x)$ is reflected in the x-axis and moved 30° right horizontally, give the equation of this new graph $h(x)$ (2)

[13]

QUESTION 7

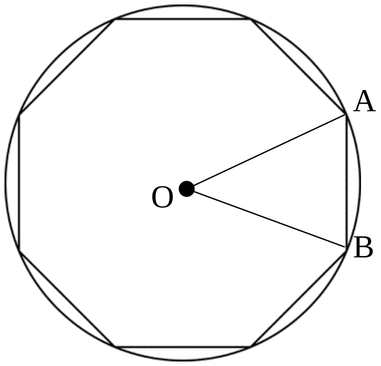
7.1 In the diagram below, $\hat{A} = 50°$; $\hat{C} = 90°$; $A\hat{B}D = 20°$ and AD = 5 m.



7.1.1 Give the size of angle $B\hat{D}C$ (1)

7.1.2 Calculate the length of BC (5)

7.2 The diagram below shows a regular octagon inscribed in a circle of radius *r* cm centre O. A and B are 2 vertices of the octagon on the circumference of the circle.



7.2.1 Determine the perimeter of the octagon in terms of *r*. (3)

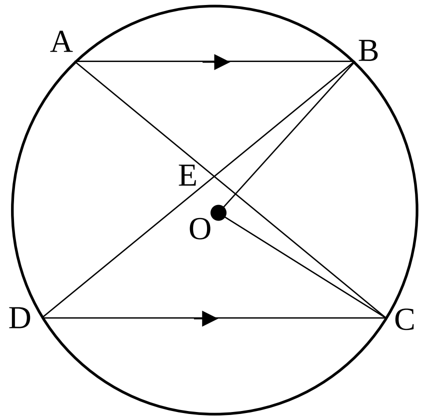
7.2.2 Show that the area of the octagon is $2\sqrt{2}.r^2$ cm^2 (4)

[13]

Give reasons for your statements in QUESTIONS 8 and 9.

QUESTION 8

8.1 In the diagram below, A, B, C and D are points on the circumference of a circle centre O. AC and DB intersect at E. AB || DC and $B\hat{O}C = 90°$



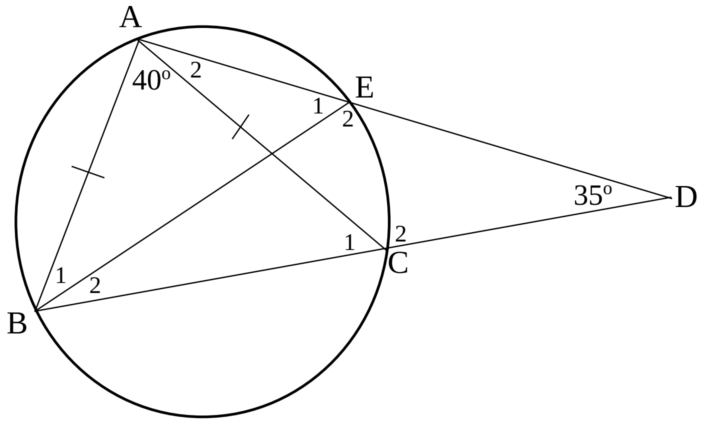
8.1.1 Determine, with reasons, 3 angles each equal to 45° (3)

8.1.2 Hence, prove that:

(a) CE = DE (2)

(b) CD is the diameter of a circle passing through ECD (2)

8.2 In the diagram below, A, B, C and E are points on the circumference of a circle. BC produced meets AE produced at point D. AB = AC. $\hat{D} = 35°$ and $\hat{A}_1 = 40°$



8.2.1 Determine, with reasons:

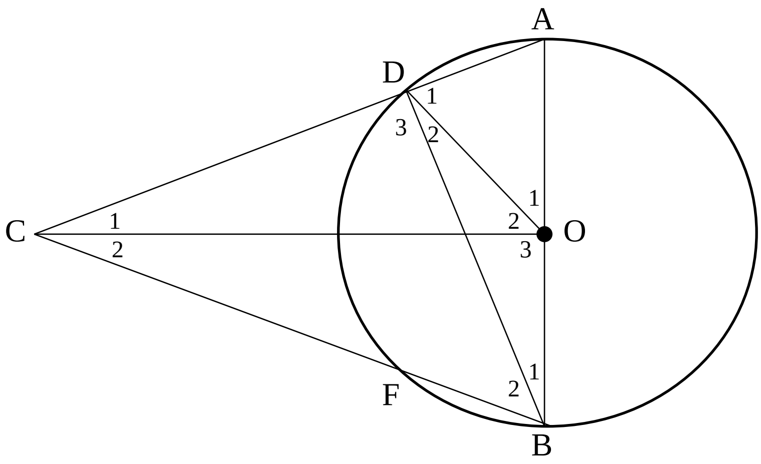
(a) $\hat{C}_1$ (2)

(b) $\hat{A}_2$ (2)

(c) $\hat{B}_2$ (2)

8.2.2 Hence prove that BE bisects $A\hat{B}C$ (3)

8.3 AB is a diameter of a circle centre O, passing through points D and F. CO ⊥ AB. ADC and BFC are straight lines.



Prove, stating reasons, that:

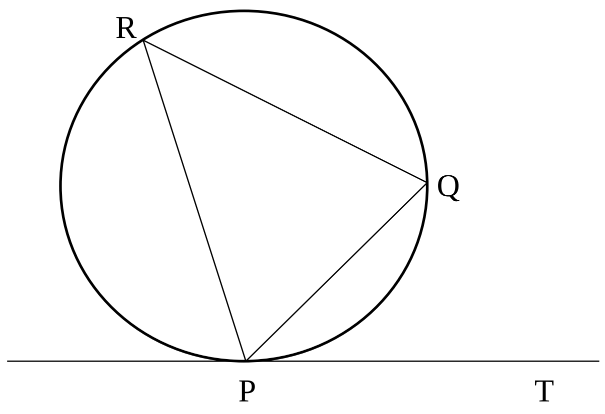
8.3.1 CDOB is a cyclic quadrilateral (4)

8.3.2 if $\hat{B}_1 = x$, then $\hat{D}_2 = \hat{C}_1$ (2)

[22]

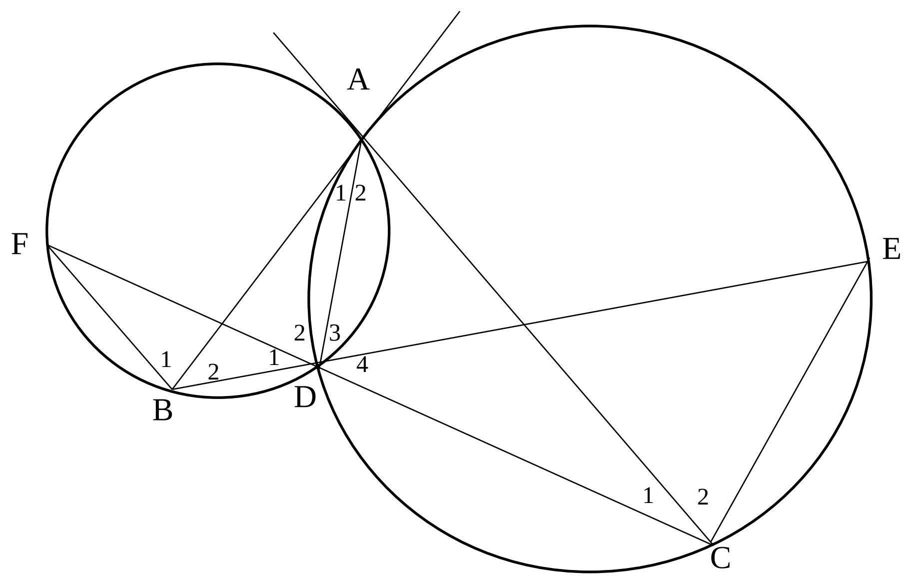
QUESTION 9

9.1 In the diagram below, PT is a tangent to the circle PQR at P.



Prove the theorem which states that $Q\hat{P}T = \hat{R}$. (5)

9.2 In the diagram below, AB is a tangent to the large circle while AC is a tangent to the smaller circle. AD is a common chord. BDE and CDF are straight lines.
Let $\hat{A}_1 = x$ and $\hat{A}_2 = y$



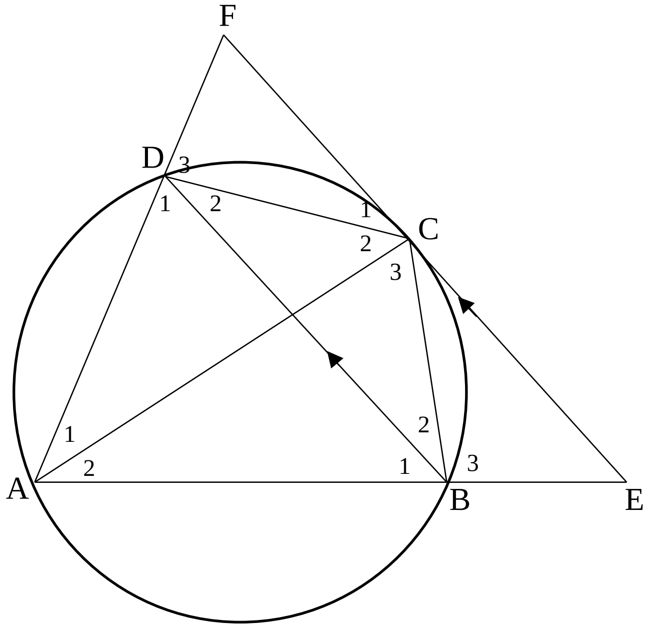
Determine, in terms of x and / or y

9.2.1 $\hat{B}_2$ (2)

9.2.2 $\hat{D}_3$ (2)

9.3 Prove that AB ∥ EC. (3)

9.4 In the diagram below, ABCD is a cyclic quadrilateral. The tangent at C meets AD produced at F and AB produced at E. BD ∥ EF.



Prove, stating reasons, that:

9.4.1 $\hat{C}_3 = \hat{F}$ (3)

9.4.2 $A\hat{C}F = C\hat{D}F$ (3)

[18]

QUESTION 10

The Shard, is comprised of an array of glass shards that merge to form an elongated pyramid. This unusual building is situated near the Thames in London and is one of the tallest buildings in the UK. The base is a square of 50 m by 50 m and the perpendicular height is 306 m.

Using the formula for the surface area of a pyramid below, answer the questions which follow.

Total surface area of a pyramid = base area + $\frac{1}{2} \times$ perimeter of the base $\times$ slant height

10.1 Determine the surface area of the glass sides of The Shard building. (4)

10.2 Determine the angle of inclination of the sloping glass sides with the horizontal base. (2)
[6]

QUESTION 11

The altitude measuring h mm, of a triangle ABC, divides the base of the triangle AB into line segments measuring x mm and y mm.

If $h^2 = x\,y$, prove that the triangle is right-angled. **[4]**

TOTAL: 150