

YOUR SCHOOL NAME HERE

Grade 12

Mathematics P2
September 2020

MARKS: 150

TIME: 3 hours

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions.
2. Answer ALL the questions.
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 answers off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An information sheet, with formulae, is included at the end of the question paper.
9. Number the answers correctly according to the numbering system used in this question paper.
10. Write legibly and present your work neatly.

***This question paper consists of 8 pages and 1 information sheet and
an answer book of 13 pages.***

QUESTION 1

The following data represents the number of people that recovered from Covid-19 in 10 African countries as at 20 July 2020.

									
8	39	63	69	104	141	183	191	301	592
Source: https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?#countries									

- 1.1 Determine the standard deviation. (2)
 - 1.2 How many countries lie within ONE standard deviation of the mean? (3)
 - 1.3 Is the following statement TRUE or FALSE? The last African country (592 recoveries), in the table, has better medical facilities than the others, therefore the number of recoveries are higher. Justify your answer. (2)
 - 1.4 After the total number of recoveries from Mozambique was added, the mean recoveries changed to 209,72. Determine how many people recovered in Mozambique. (2)
- [9]**

QUESTION 2

The table below represents the number of Covid-19 deaths (per week) recorded, for 5 weeks, in South Africa, since 01 May 2020.

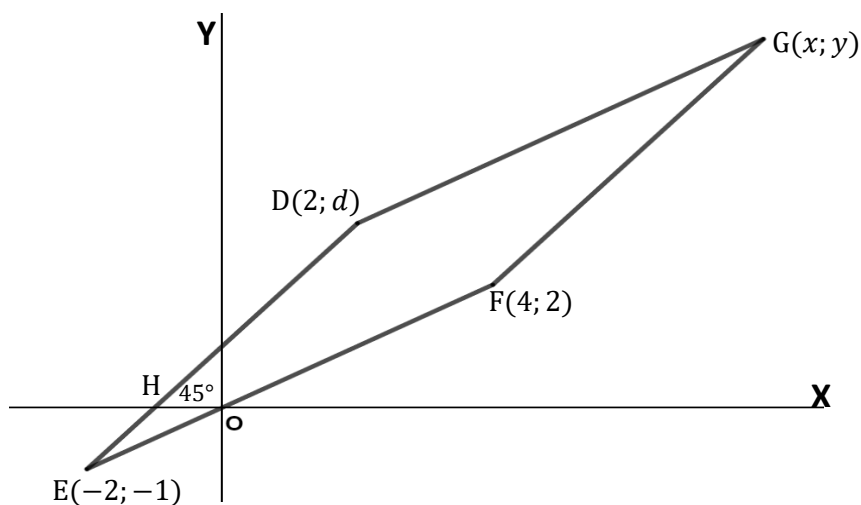
Week	1	2	3	4	5
No of Deaths	62	69	160	236	265
Source: https://www.worldometers.info/coronavirus/country/south-africa/					

- 2.1 Represent the information above in a scatter plot on the grid provided in your ANSWER BOOK. (2)
- 2.2 Determine the equation of the least squares regression line (2)
- 2.3 Draw the least squares regression line on the scatter plot in your ANSWER BOOK. (2)
- 2.4 Determine the correlation coefficient of the above data and describe the relation between the weeks and the number of deaths. (2)
- 2.5 Why is this situation unlikely to continue forever? (1)
- 2.6 Estimate the number of deaths in week 12. (2)
- 2.7 The **actual** number of deaths in week 12 was 1747. Give a possible reason for the difference. (1)

[12]

QUESTION 3

- 3.1 Given: Parallelogram DEFG with $D(2; d)$, $E(-2; -1)$, $F(4; 2)$ and $G(x; y)$. H is a point on the x -axis and $\widehat{DHX} = 45^\circ$.

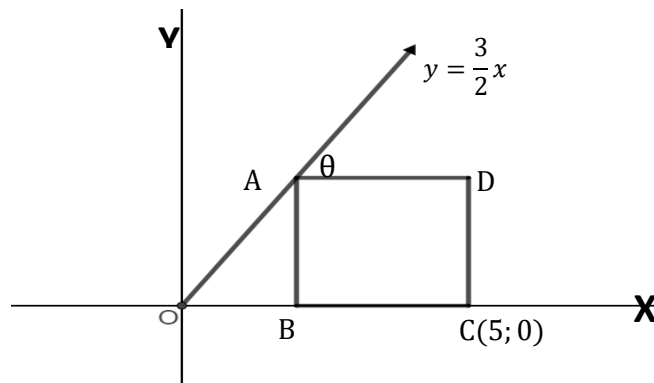


- 3.1.1 Calculate the length of EF (2)
- 3.1.2 Show that the gradient of ED = 1 (1)
- 3.1.3 Hence show that $d = 3$ (2)
- 3.1.4 Determine the equation of GF (3)
- 3.1.5 Determine the coordinates of G (2)
- 3.1.6 Calculate the length of ED, and hence show, without a calculator, that:

$$\frac{EF}{ED} = \frac{3\sqrt{10}}{8} \quad (4)$$

- 3.1.7 The circle with centre F and radius EF is translated 4 units to the left and 2 units down. Write down the equation of the new circle. (3)

- 3.2 In the diagram, point A lies on the line with equation $y = \frac{3}{2}x$, and is one vertex of square ABCD. Point C has coordinates (5; 0). The angle between the line and side AD of the square is θ .



3.2.1 Calculate the size of θ (2)

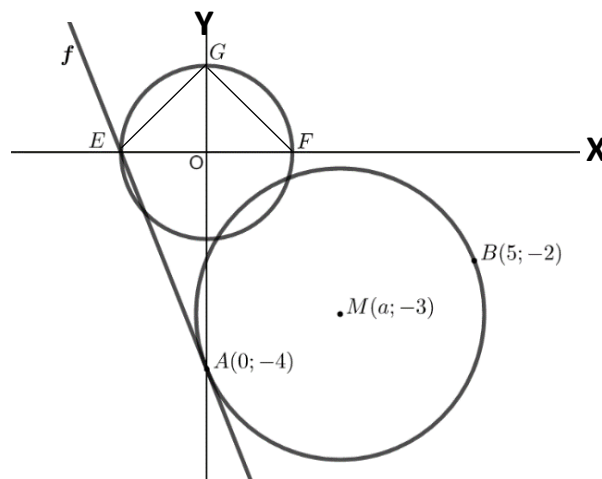
3.2.2 Determine the coordinates of point A (5)
[24]

QUESTION 4

- 4.1 Determine the coordinates of the centre of the circle with equation:

$$x^2 - 10x + y^2 + 6y - 2 = 0. \quad (5)$$

- 4.2 In the diagram, two circles are drawn. The circle with centre at the origin has equation $x^2 + y^2 = \frac{64}{25}$. It cuts the x -axis at E and F, and the y -axis at G. EG and GF are drawn. The circle with centre $M(a; -3)$ goes through the points $B(5; -2)$ and $A(0; -4)$. The tangent to the larger circle at A has equation $f(x) = -\frac{5}{2}x - 4$, and intersects the smaller circle and the x -axis at E.



4.2.1 Write down the coordinates of G (2)

4.2.2 Calculate the area of $\triangle EFG$ (2)

4.2.3 Determine the equation of MA, the radius of circle M (2)

4.2.4 Determine the equation of the larger circle (4)
[15]

QUESTION 5

5.1 Simplify the following to a single trigonometrical ratio:

$$\sin(90^\circ + x) \cdot \cos(-x) - \cos(180^\circ - x) \tan(x - 180^\circ) \cdot \sin(x) \quad (5)$$

5.2 If $\sin 42^\circ \cdot \cos 14^\circ = a$ and $\cos 42^\circ \cdot \sin 14^\circ = b$, determine the following in terms of a and b .

5.2.1 $\sin 56^\circ$ (2)

5.2.2 $\sin 28^\circ$ (2)

5.2.3 $\cos 56^\circ$ (3)

5.3 Given:

$$\frac{\cos 2\theta + \sin^2 \theta}{1 + \sin \theta} = 1 - \sin \theta$$

5.3.1 Prove the identity. (4)

5.3.2 For which value(s) of x will the identity be **invalid**? (2)

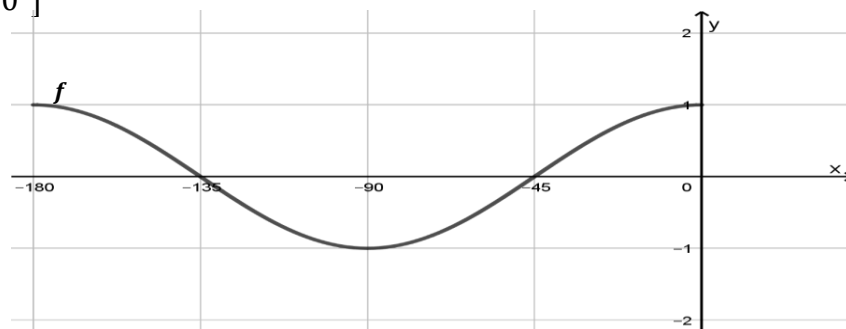
5.4 Determine the value of $\tan \theta$, if the distance between the point $(\cos \theta; \sin \theta)$ and $(-2; 1)$ is $\sqrt{6}$. (3)

[21]

QUESTION 6

6.1 Solve for x for the interval $x \in [-180^\circ; 0^\circ]$ if $\sin x = \cos 2x - 1$ (6)

6.2 In the diagram below, the graph of $f(x) = \cos 2x$ is drawn for the interval $x \in [-180^\circ; 0^\circ]$



6.2.1 Draw the graph of $g(x) = \sin x + 1$ for the interval $x \in [-180^\circ; 0^\circ]$ on the grid given in your ANSWER BOOK. Show ALL the intercepts with the axes, as well as the turning points. (2)

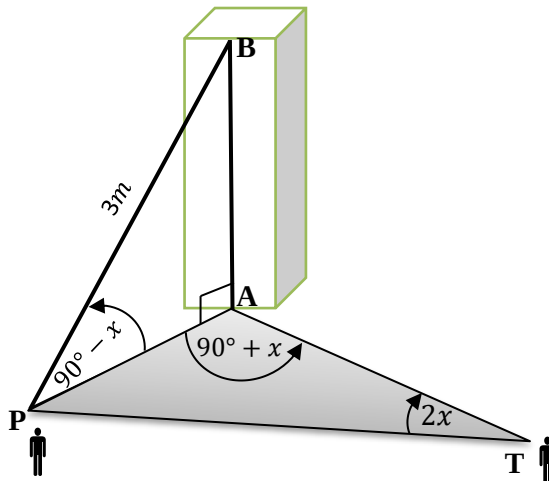
6.2.2 If $h(x)$ is the reflection of $g(x)$ in the x -axis, write down the equation of $h(x)$. (1)

6.2.3 For which value(s) of x will $f(x - 45^\circ) \geq 0$? (2)

[11]

QUESTION 7

Peter and Thando are standing at points P and T respectively while waiting to be sanitised before entering the school building. A surveillance camera is positioned at B, as shown below. Peter is $3m$ away from the camera. The angle of elevation from Peter to the camera is $(90^\circ - x)$, $\widehat{PAT} = (90^\circ + x)$ and $\widehat{PTA} = 2x$.



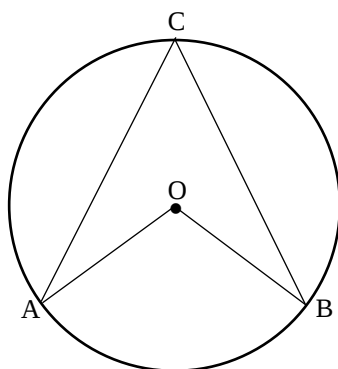
7.1 Determine AP in terms of x (2)

7.2 Hence, determine if these learners comply with the social distancing regulations of being $1.5m$ apart? (4)

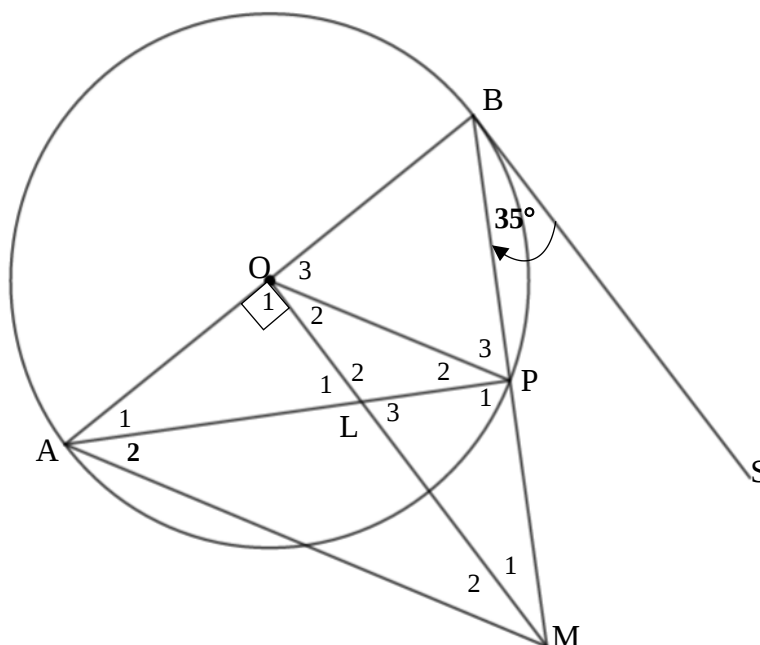
7.3 If $x = 20^\circ$, determine the area of $\triangle PTA$ (3)
[9]

QUESTION 8

8.1 O is the centre of the circle through A, B and C in the diagram. Use the diagram to prove the theorem which states that $\widehat{AOB} = 2 \widehat{ACB}$ (5)



- 8.2 O is the centre of the circle in the diagram.
- BP is produced to M such that $OM \perp AB$.
 - AP intersects OM at L.
 - BS is a tangent to the circle at B.
 - $\widehat{MBS} = 35^\circ$



8.2.1 Calculate, with reasons, the size of:

- | | |
|---------------------|-----|
| (a) $\widehat{A}_1$ | (2) |
| (b) $\widehat{O}_3$ | (2) |
| (c) $\widehat{P}_3$ | (2) |
| (d) $\widehat{M}_1$ | (3) |

8.2.2 Prove that:

- | | |
|---|-----|
| (a) OLPB is a cyclic quadrilateral. | (3) |
| (b) $BS \parallel OM$. | (2) |
| (c) OP is a tangent to the circle through P, L and M. | (3) |

[22]

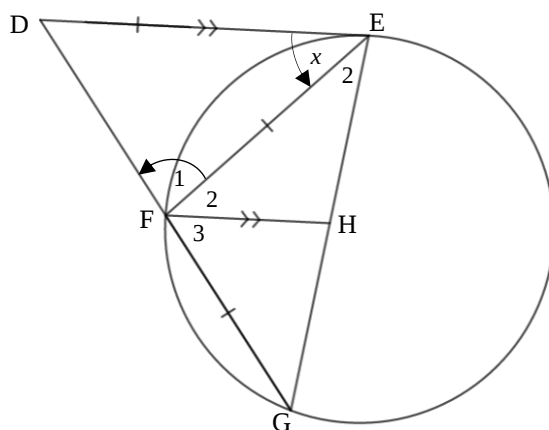
QUESTION 9

In the diagram is:

- DE a tangent to the circle at E .
- DFG is a straight line.
- $DE = EF = FG$
- $HF \parallel DE$.

It is further given that $\frac{DF}{DE} = y$.

- Let $\widehat{DEF} = x$.



9.1 Give, with reasons, THREE other angles equal to x . (6)

9.2 Prove that:

9.2.1 $\frac{EH}{HG} = y$ (3)

9.2.2 $\widehat{D} = 72^\circ$ (5)

9.2.3 $\triangle DGE \parallel \triangle DEF$ (3)

9.2.4 $DE^2 = DF \cdot DG$ (2)

9.2.5 $y^2 + y = 1$ (5)

9.2.6 $\cos 72^\circ = \frac{1}{2}y$ (3)

TOTAL [27]
150

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}(2a + (n - 1)d)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} ; r \neq 1$$

$$S_\infty = \frac{a}{1 - r} ; -1 < r < 1$$

$$F = \frac{x[(1 + i)^n - 1]}{i}$$

$$P = \frac{x[1 - (1 + i)^{-n}]}{i}$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

$$(x - a)^2 + (y - b)^2 = r^2$$

$$\text{In } \triangle ABC: \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A \quad \text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

$$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2\sin^2 \alpha \\ 2\cos^2 \alpha - 1 \end{cases}$$

$$\sin 2\alpha = 2\sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$