GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

NOVEMBER 2021

GRADE 11

MATHEMATICS
(PAPER 2)

TIME: **3 hours**

MARKS: **150**

11 pages

EXEMPLAR

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 11 questions.
2. Answer ALL the questions.
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. Use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.
6. If necessary, answers should be rounded-off to TWO decimal places, unless stated otherwise.
7. THREE diagram sheets for QUESTION 2.1.2, QUESTION 6.2 and QUESTION 9.2 are attached at the end of this question paper. Write your name on these diagram sheets in the spaces provided and insert them inside the back cover of your ANSWER BOOK.
8. Number the answers correctly according to the numbering system used in the question paper.
9. Write neatly and legibly.

EXEMPLAR

QUESTION 1

The data below shows the number of people visiting a local clinic per day to be vaccinated against COVID-19.

5	12	19	29	35
23	15	33	37	21
26	18	23	18	13
21	18	22	20	

1.1 Determine the mean of the given data. (1)

1.2 Calculate the standard deviation of the data. (2)

1.3 Determine the number of people vaccinated against COVID-19 that lies within **ONE** standard deviation of the mean. (2)

1.4 Determine the interquartile range for the data. (3)

1.5 Draw a box and whisker diagram to represent the data. (3)

1.6 Identify any outliers in the data set. Substantiate your answer. (2)

[13]

QUESTION 2

The table below shows the height (in cm) of 250 Grade 11 learners.

Height (cm)	Number of learners (f)	Cumulative frequency
$145 \leq x < 150$	6	6
$150 \leq x < 155$	23	29
$155 \leq x < 160$	60	
$160 \leq x < 165$	74	163
$165 \leq x < 170$	52	
$170 \leq x < 175$	32	
$175 \leq x < 180$	3	250
Total	**250**	

2.1 Complete the cumulative frequency column of the table. (3)

2.2 On the set of axes below, sketch the ogive for the data above. (3)

2.3 Use your graph to estimate the median and the interquartile range for the heights of the Grade 11 learners. Show where you read the answers off your graph. (4)

EXEMPLAR

2.4 In which class interval does the upper quartile lie? (1)

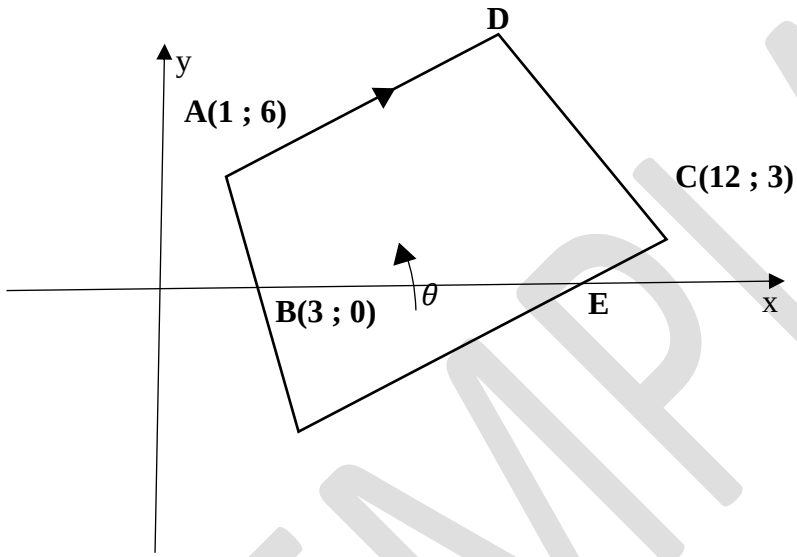
2.5 What percentage of the learners are 170cm or taller in height? (1)

2.6 Determine the standard deviation of the heights of the learners in Grade 11. (2)

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QUESTION 3

A (1; 6), B (3; 0), C (12; 3) and D are the vertices of a trapezium with AD || BC. E is the midpoint of BC. The angle of inclination of the straight line BC is θ, as shown in the diagram.



3.1 Calculate the coordinates of E. (2)

3.2 Determine the gradient of the line BC. (2)

3.3 Calculate the magnitude of θ. (2)

3.4 Prove that AD is perpendicular to AB. (3)

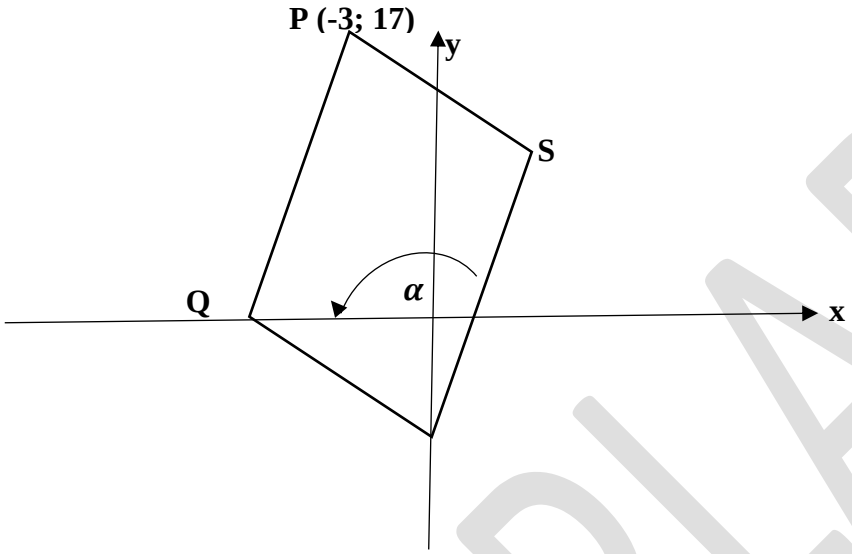
3.5 A straight line passing through vertex A does not pass through any of the sides of the trapezium. This line makes an angle of 45° with side AD of the trapezium. Determine the equation of this straight line. (4)

[13]

EXEMPLAR

QUESTION 4

In the diagram below, P (–3; 17), Q, O and S are the vertices of a parallelogram. The sides OS and OQ are defined by the equations $y = 6x$ and $y = -x$ respectively. $Q\hat{O}S = \alpha$.



4.1 Determine the equation of QP in the form $y = mx + c$. (2)

4.2 Hence, determine the coordinates of Q. (3)

4.3 Calculate the length of OQ. Leave your answer in simplified surd form. (2)

4.4 Calculate the size of α. (3)

4.5 If OS = 148 units, calculate the length of QS. (3)

[13]

EXEMPLAR

QUESTION 5

5.1 If cos 62° = k, determine the value of each of the following in terms of k:

5.1.1 sin 28° (2)

5.1.2 cos 242° (2)

5.2 Simplify to a single ratio:

$$\frac{\tan(360° - x).\sin(90° + x)}{\sin(-x)}$$ (4)

5.3 Without the use of a calculator, simplify the following:

$$\frac{\cos 130° - .\sin(90° - \theta)}{\sin 400° + \cos(-\theta)}$$ (5)

5.4 Evaluate $\sqrt{4^{sin150°}.2^{3tan135°}}$ without the use of a calculator. (3)

5.5 Consider $4\sin^2 x - 3 = 0$ for $0° \leq x \leq 270°$.

5.5.1 In how many quadrants will there be solutions for this equation? (1)

5.5.2 Without the use of a calculator, solve for x, giving all possible values of x. (3)

[20]

QUESTION 6

6.1 Given: $f(x) = \tan x - 1$ and $g(x) = \cos 2x$

Sketch the graphs of f and g on the same system of axes for the interval $x \in (-90° ; 180°]$ (5)

6.2 Determine graphically the value(s) of x for which:

6.2.1 $\cos 2x + 1 = \tan x$ (1)

6.2.2 $2\cos^2 x = 1$ (2)

6.2.3 $f(x).g(x) > 0$ (2)

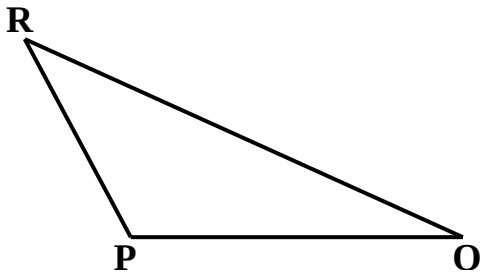
6.3 Write the equation of $h(x)$ result from shifting $g(x)$ 30° to the right. (1)

[11]

EXEMPLAR

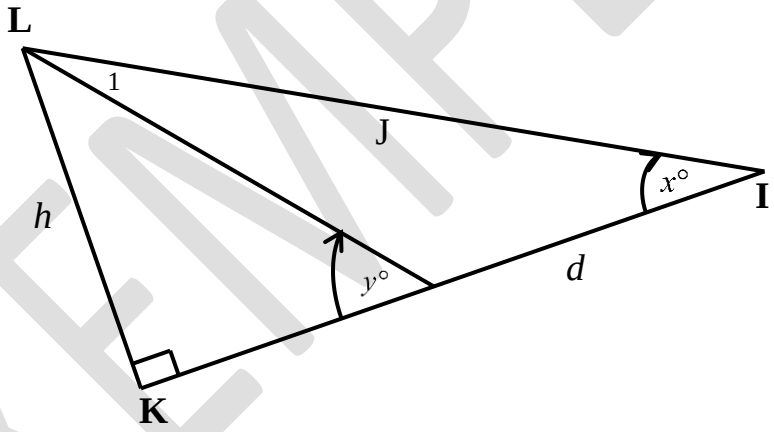
QUESTION 7

7.1 In Δ PQR, $\hat{P}$ is an obtuse angle.



Redraw the sketch in your ANSWER BOOK and prove that $\frac{p}{\sin P}=\frac{q}{\sin Q}$ (5)

7.2 From I, the angle of elevation to the top of a vertical pole KL is $x°$ along a gentle slope KI and from point J, d meters closer to the tower, the angle of elevation is $y°$.



7.2.1 Show that the height of the tower is given by $h=\frac{d.\sin x\sin y}{\sin(y-x)}$. (5)

7.2.2 Calculate the height of the tower if d = 70 m, x = 12° and y = 30°. (2)

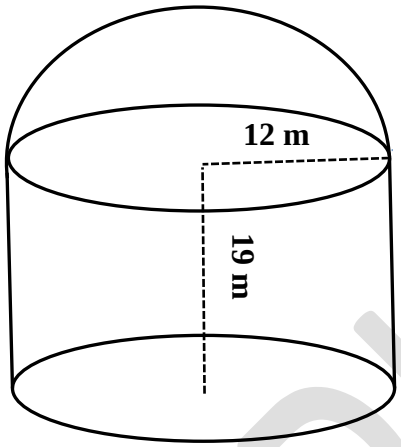
[12]

EXEMPLAR

QUESTION 8

Consider a community reservoir tank in the shape and form below, made from a cylinder with a height of 19 m and a hemisphere (half of sphere) with a radius of 12 m.

(Formulae: $V = \frac{4}{3}\pi r^3$; $V = \pi r^2 h$; $TSA = 2\pi r^2 + 2\pi rh$; $TSA = 4\pi r^2$)



8.1 Calculate the volume of the tank. (*Leave the answer in π.*) (6)

8.2 Calculate the total exterior surface area of the tank. (*Round off to the nearest square meter.*) (6)

[12]

EXEMPLAR

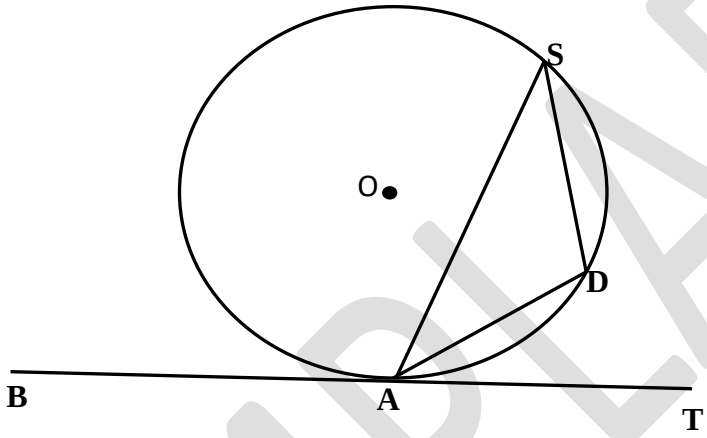
QUESTION 9

9.1 Copy and complete the statements of the following theorems.

9.1.1 The opposite angles of a cyclic quadrilateral are … (1)

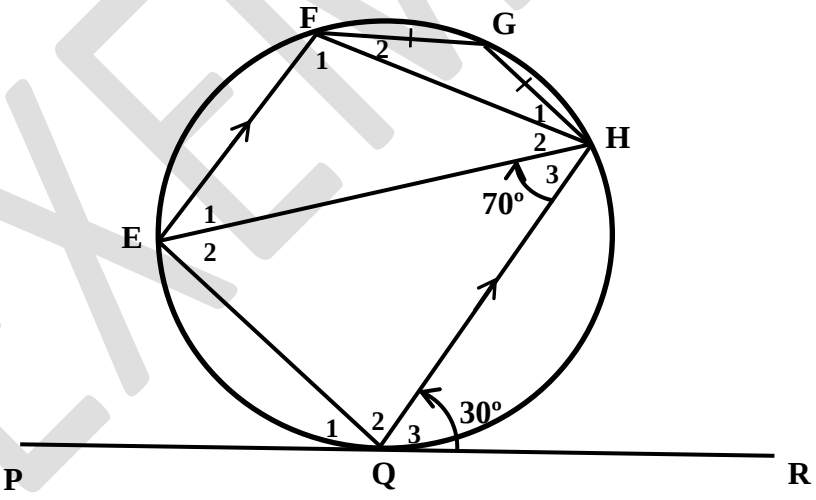
9.1.2 The angle between a tangent and a chord is … (1)

9.2 BAT is a tangent to circle O. Use the sketch and prove the theorem that states that $B\hat{A}S = \hat{D}$



(6)

9.3 PQR is a tangent to circle QEFGH. EF ∥ QH. FG = GH. Let $\hat{Q}_3 = 30°$ and $\hat{H}_3 = 70°$.



9.3.1 Calculate $\hat{Q}_1$ (2)

9.3.2 Prove that $\hat{G} = 110°$ (4)

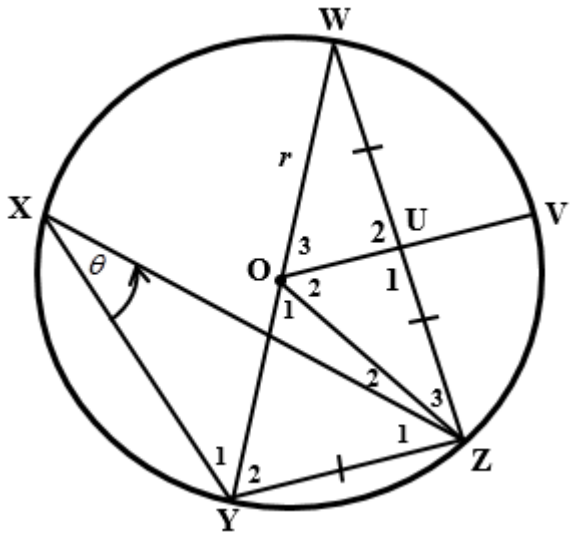
9.3.3 Calculate $\hat{F}_1$ (4)

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EXEMPLAR

QUESTION 10

O is the centre of the circle VWXYZ and U is the midpoint of chord WZ as indicated in the diagram. WOY is a straight line. OW = radius = *r*.



10.1 Express the following in terms of θ with reason:

10.1.1 $\hat{O}_1$ (2)

10.1.2 $\hat{W}$ (2)

10.1.3 $\hat{Y}_2$ (2)

10.2 Determine YZ in terms of (*r*). (4)

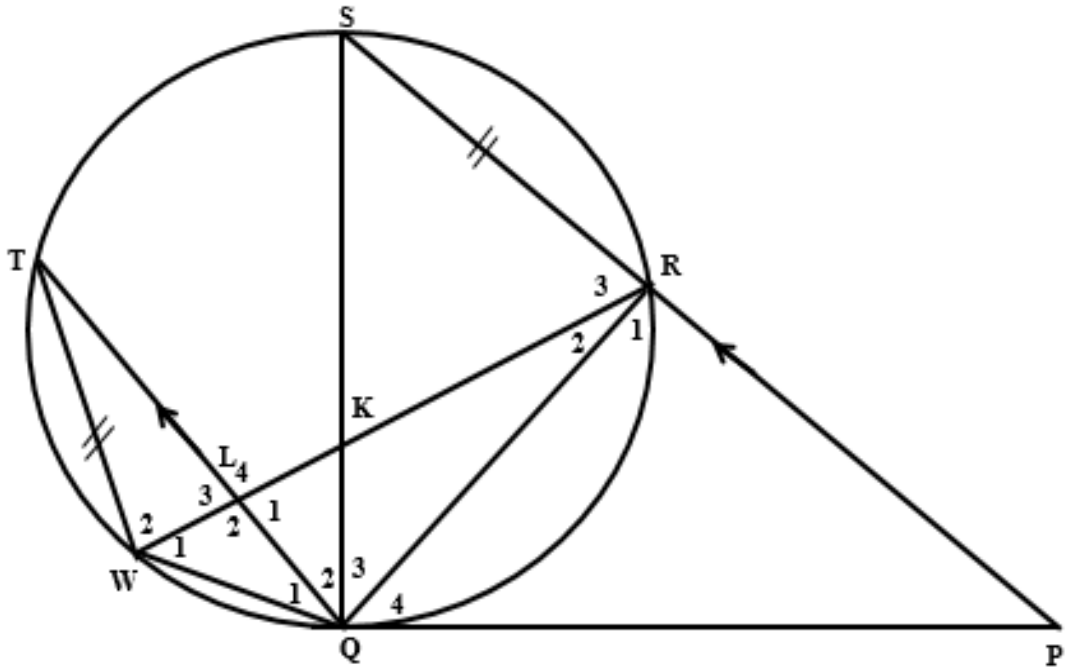
10.3 Hence or otherwise, calculate the value of UV if it is further given that OU = 2cm and UW = 4cm. (2)

[12]

EXEMPLAR

QUESTION 11

In the diagram below, PQ is a tangent to circle SRQWT at Q. PRS is a straight line. RW cuts SQ and QT at K and L respectively.



11.1 Find, with reasons, three other angles equal to *x*. (3)

11.2 Prove that:

11.2.1 $\hat{R}_1 = \hat{L}_3$ (4)

11.2.2 PRKQ is a cyclic quadrilateral. (5)

[12]

TOTAL: 150

END