



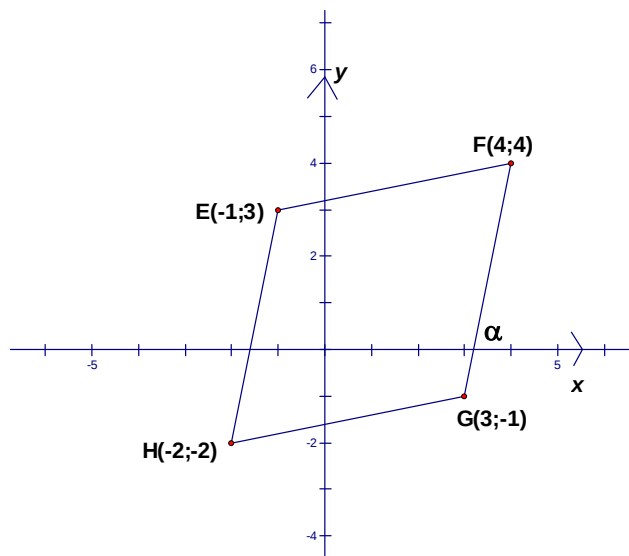
## MATHEMATICS PAPER 2 QUESTIONS

MARKS: 150

TIME: 3 hours

### QUESTION 1

In the diagram alongside, quadrilateral EFGH has vertices  $E(-1; 3)$ ,  $F(4; 4)$ ,  $G(3; -1)$  and  $H(-2; -2)$ .

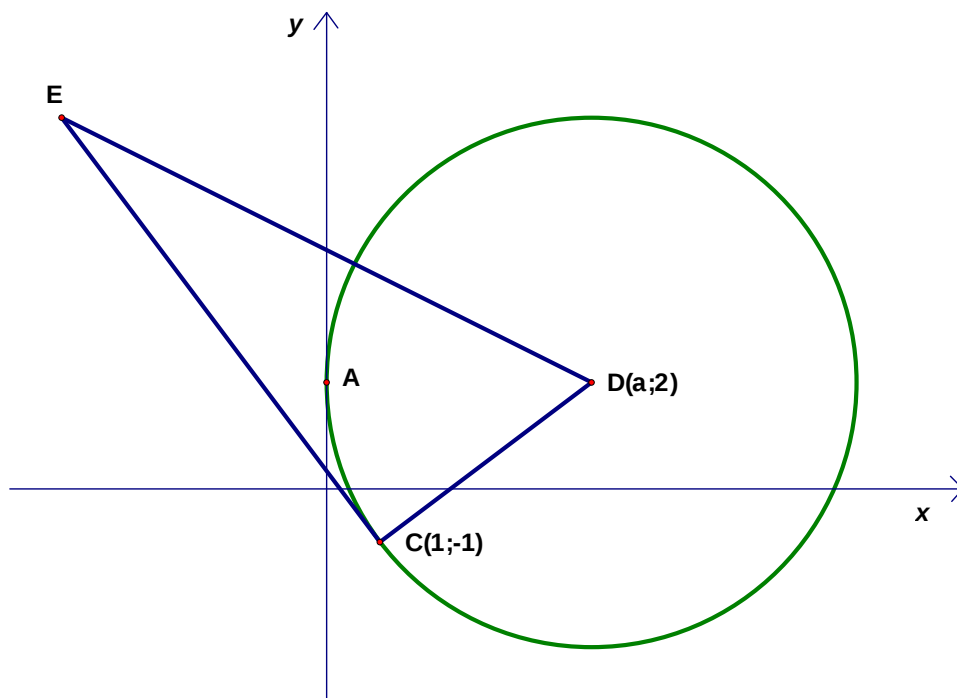


- 1.1 Determine the coordinates of M, the midpoint of EG. (2)
- 1.2 Show that EG and FH bisect each other. (2)
- 1.3 Show that EFGH is a rhombus. (4)
- 1.4 Find the equation of line EG. (3)

- 1.5 Does the point  $(\frac{5}{2}; -\frac{3}{4})$  lie on the line EG? Justify your answer. (3)
- 1.6 Calculate the value of  $\alpha$ , the angle that the line FG makes with the positive direction of the  $x$ -axis. (3)
- 1.7 Determine the area of  $\triangle EGH$ . (4)
- 1.8 Determine the coordinates of P, a point in the second quadrant, so that EGHP is a parallelogram. (2)
- [23]**

**QUESTION 2**

In the figure below, EC is a tangent to the circle with centre  $D(a; 2)$ .  $EC = 12$  units and  $ED = 13$  units. C is the point  $(1; -1)$ . The circle touches the  $y$ -axis at point A.

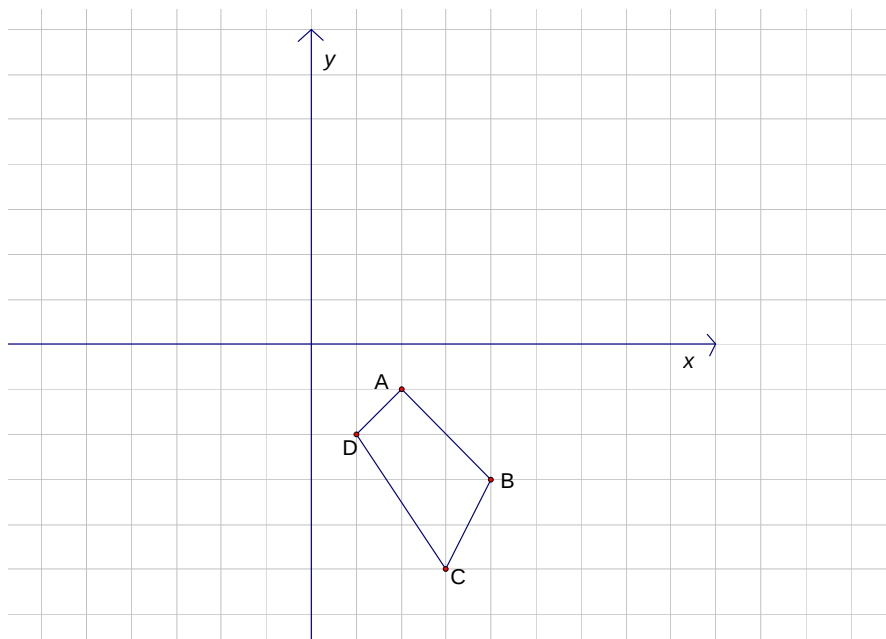


Determine

- 2.1 the length of DC (2)
  - 2.2 the value of  $a$  (5)
  - 2.3 the equation of the tangent to the circle at point C (4)
  - 2.4 the coordinates of point A (2)
  - 2.5 the equation of the circle with centre C, passing through point A. (5)
- [18]**

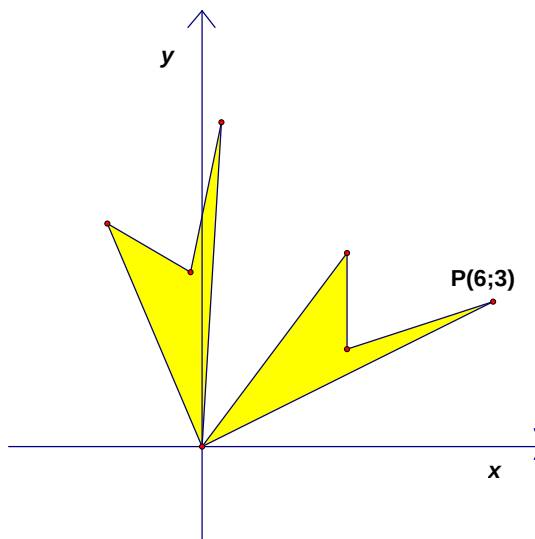
**QUESTION 3**

The vertices of quadrilateral ABCD are shown on the grid. The coordinates are A(2; -1), B(4; -3), C(3; -5) and D(1; -2).



- 3.1 Each of the points on the grid is rotated about the origin in an anticlockwise direction through an angle of  $90^\circ$ . Sketch and label the vertices of A'B'C'D', the image of ABCD, on the grid. Give only the **coordinates** of point C'. (5)
- 3.2 Each of the points A, B, C and D is also reflected in the line  $y = -x$ . Sketch and label A''B''C''D'', the image of ABCD after this transformation. Show only the **coordinates** of point B''. (5)
- 3.3 Consider a general point P(x; y). Write down the image of P(x; y) after it has undergone the following two transformations: a rotation of  $180^\circ$  about the origin, followed by an enlargement of factor  $\frac{4}{5}$ . (2)
- 3.4 If the area of quadrilateral ABCD in the sketch is  $p$  units<sup>2</sup>, what is its area after undergoing the two transformations described in 3.3? (2)

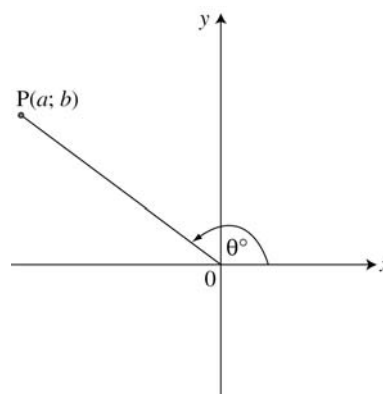
**[14]**

**QUESTION 4**

- 4.1 A quadrilateral is rotated as shown in the sketch. Determine the coordinates of the image of point  $P(6; 3)$  after a rotation of  $60^\circ$  about the origin. Give your answer in the simplest surd form. (5)
- 4.2 Instead of the above rotation, the original quadrilateral is reflected in  $y = x$  and then in the line  $y = 0$ . Give the coordinates of the final image of  $P$ . (2)

**[7]****QUESTION 5**

- 5.1 The point  $P(a; b)$  is joined to the origin and the line  $OP$  makes an angle of  $\theta^\circ$  with the  $x$ -axis.

Find, in terms of  $a$  and  $b$ ,

5.1.1  $\tan \theta$  (1)

5.1.2  $\cos(-\theta)$ . (4)

- 5.2 If  $\sin 37^\circ = k$ , determine, in terms of  $k$ ,

5.2.1  $\cos 53^\circ$  (2)

5.2.2  $\sin(-74^\circ)$ . (4)

5.3 Without using a calculator, prove that:

$$5.3.1 \quad \frac{\sin \alpha \cdot \sin 2\alpha}{\cos \alpha} + \cos 2\alpha = 1 \quad (4)$$

$$5.3.2 \quad \frac{\sin 234^\circ}{\cos 36^\circ} - \frac{\sin(x - 90^\circ) \cos(90^\circ - 2x)}{\sin(x - 360^\circ)} = \cos 2x \quad (8)$$

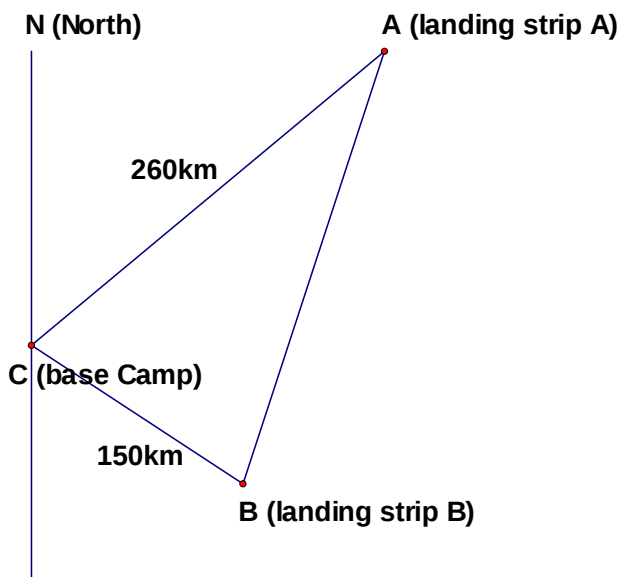
5.4 Determine the general solution for  $3\cos^2 x + 5\sin x = 3$ .

(6)

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### QUESTION 6

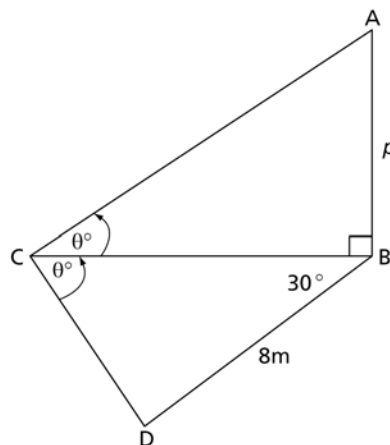
- 6.1 Rangers often use light aircraft to monitor the position of animals in game reserves. The diagram below shows the position of two landing strips that planes use and the base camp. Landing area A is on a bearing of  $50^\circ$  from the base camp, C, and landing area B is on a bearing of  $110^\circ$  from the base camp. That means  $\angle NCA = 50^\circ$  and  $\angle NCB = 110^\circ$ . The distance from C to A is 260 km and the distance from C to B is 150 km.



Determine the distance a pilot would have to fly from point A to point B. Answer correct to the nearest kilometre.

(5)

- 6.2 In the diagram shown, B, C and D are three points on the same horizontal plane and AB is a vertical pole of length  $p$  metres. The angle of elevation of A from C is  $\theta$  and  $\widehat{BCD} = \theta$ . Also,  $\widehat{CBD} = 30^\circ$  and  $BD = 8$  m.



- 6.2.1 Express  $\widehat{CDB}$  in terms of  $\theta$ . (1)

- 6.2.2 Hence show that  $p = \frac{8 \sin(30^\circ + \theta)}{\cos \theta}$ . (6)

[12]

### QUESTION 7

Consider the functions  $f(x) = \sin 2x$  and  $g(x) = \cos(x - 45^\circ)$  for  $x \in [-180^\circ; 180^\circ]$ .

- 7.1 Solve for  $x$  if  $\sin 2x = \cos(x - 45^\circ)$ . (8)

- 7.2 Sketch the graphs of  $f$  and  $g$  on the same system of axes for  $x \in [-180^\circ; 180^\circ]$ . (6)

- 7.3 Determine for which values of  $x \in [-180^\circ; 90^\circ]$  is

- 7.3.1  $g(x) \leq f(x)$  (3)

- 7.3.2  $\frac{f(x)}{g(x)}$  undefined. (2)

[19]

**QUESTION 8**

- 8.1 A potato packing company does a survey to determine whether a consistent number of potatoes is being packed in each 10 kg bag that is sold. A sample of 15 bags was taken and the number of potatoes in each was counted. The results are in the table below.

| Bag number         | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|--------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Number of potatoes | 60 | 75 | 50 | 60 | 66 | 65 | 65 | 45 | 70 | 72 | 66 | 80 | 64 | 70 | 71 |

Determine

- 8.1.1 the mean number of potatoes per bag (3)
- 8.1.2 the standard deviation of the data (2)
- 8.1.3 how many bags from this group would be rejected if the company only sells bags within one standard deviation of the mean. (3)
- 8.2 A survey was done to determine the number of patients attending out-patient clinics in a certain province during the course of one month. Ten clinics were selected from around the province for this survey. The results are given in the table below, rounded to the nearest 100 patients.

| Clinic | Number of patients per month |
|--------|------------------------------|
| A      | 12 600                       |
| B      | 16 800                       |
| C      | 15 400                       |
| D      | 19 600                       |
| E      | 16 500                       |
| F      | 15 300                       |
| G      | 18 600                       |
| H      | 11 000                       |
| I      | 14 200                       |
| J      | 14 500                       |

- 8.2.1 Determine the five-number summary for the data. (5)
- 8.2.2 Draw a box-and-whisker plot from your answer to 8.2.1. (3)
- 8.2.3 If the clinics were open for 28 days per month, determine the maximum and the minimum number of patients who attended these clinics per day. (2)

**[18]**

**QUESTION 9**

The matric results of the 245 learners at a certain school were recorded as follows:

| Marks                | Frequency | Cumulative frequency |
|----------------------|-----------|----------------------|
| $20 \leq x \leq 29$  | 4         | 4                    |
| $30 \leq x \leq 39$  | 12        |                      |
| $40 \leq x \leq 49$  | 30        |                      |
| $50 \leq x \leq 59$  | 82        |                      |
| $60 \leq x \leq 69$  | 55        |                      |
| $70 \leq x \leq 79$  | 35        |                      |
| $80 \leq x \leq 89$  | 24        |                      |
| $90 \leq x \leq 100$ | 3         |                      |

- 9.1 Complete the cumulative frequency table. (2)
- 9.2 Draw an ogive to represent the data, using a suitable scale on the axes. (4)
- 9.3 Use your ogive to determine the approximate median value. On your graph, show where you obtained your answer. (2)
- 9.4 Why is it not possible to obtain the exact mean or median of this data set? (2)

**[10]**