

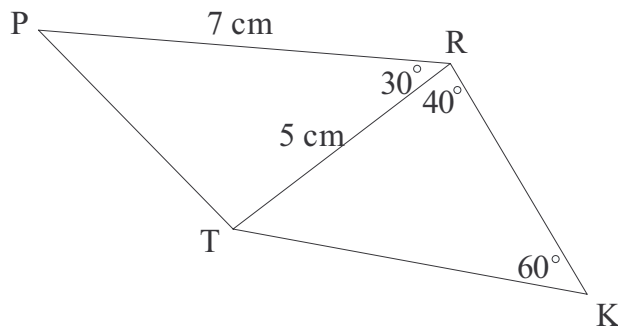
Grade 11 Mathematics: Question Paper 2

MARKS: 150

TIME: 3 hours

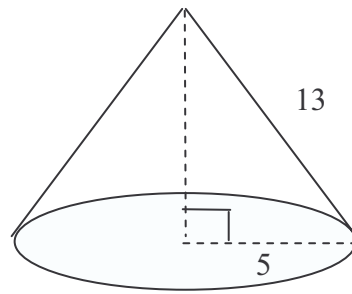
QUESTION 1

- 1.1 A triangle is drawn with vertices A (0;2) ; B (4;5) and C (4;-4).
 1.1.1 Find the length of AB. (2)
 1.1.2 Find the equation of the line through B and C. (1)
 1.1.3 Find the equation of the line through A and B. (2)
 1.1.4 Find the inclination of the line through A and B. (2)
- 1.2 What will be the gradient of the line perpendicular to $3x + 2y - 7 = 0$? (2)
- 1.3 Using a calculator find the values of the following if $x = 42^\circ$ and $y = 127,8^\circ$:
 1.3.1 $\sin 3x$ (1)
 1.3.2 $\cos^2(3x - y) - 2$ (2)
- 1.4 Simplify: $\frac{\sin(180^\circ + A)}{\sin(90^\circ - A)}$ (3)
- 1.5 Find the solution to $3 \tan 2x = 1$ on the interval $x \in [0, 270^\circ]$ (4)
- 1.6 Consider the diagram below:



- 1.6.1 Find the length of KT. (3)
 1.6.2 Find the length of PT. (3)
- 1.7 Draw, on the graph paper on your diagram sheet, a box and whisker diagram for a set of data with the following characteristics:
- Median is 17
 - Upper quartile is 20
 - Lower quartile is 11
 - Maximum value is 30
 - Range is 20
- (5)

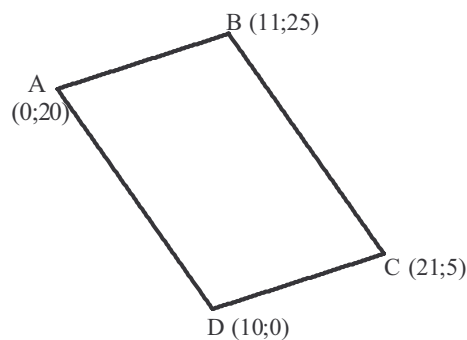
- 1.8 Find the volume of the right cone with slant height 13 mm and with radius of base 5 mm.



(3)
[33]

QUESTION 2

Consider parallelogram ABCD with co-ordinates as shown in the diagram below.

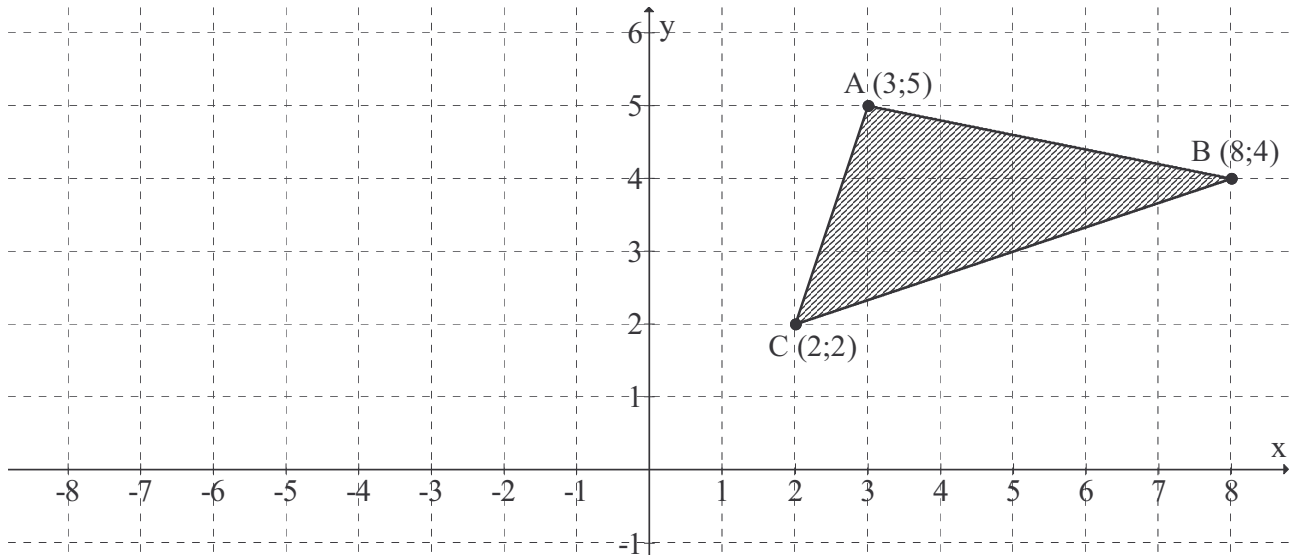


- 2.1 List two properties that are true of a rectangle which are not true of all parallelograms. (2)
- 2.2 Find the lengths of AC and BD (leave your answers in surd form). (4)
- 2.3 Find the gradients of AB and AD. (4)
- 2.4 Is ABCD a rectangle? Give two detailed reasons using your answers from 2.2 and 2.3. (2)

[12]

QUESTION 3

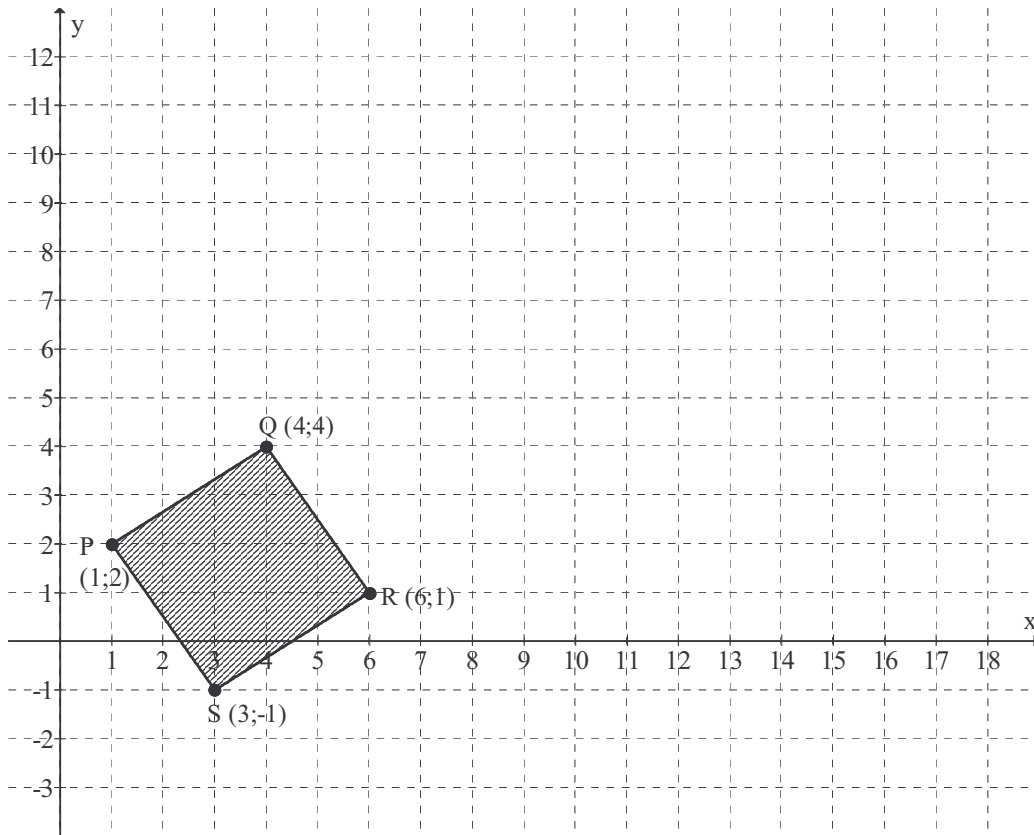
A triangle with vertices A (3;5); B (8;4) and C (2;2) is drawn. A copy of this diagram appears on your diagram sheet.



- 3.1 Give the co-ordinates of the vertices of the image $A'B'C'$ of ΔABC when it is rotated 90 degrees anti-clockwise around the origin. (5)
 - 3.2 Complete the generalisation of this transformation:
 $(x; y) \longrightarrow (\dots\dots\dots ; \dots\dots\dots)$ (2)
 - 3.3 Find the equation of the perpendicular bisector of BB' . (5)
 - 3.4 Given that the equation of AA' is $y = -4x$, show that AA' and BB' intersect at the centre of rotation. (3)
 - 3.5 Give the co-ordinates of the vertices of $A''B''C''$ if it is the image of ΔABC when it is rotated through an angle of 180° . (3)
- [18]**

QUESTION 4

Square PQRS has vertices with co-ordinates as shown in the diagram below. This diagram is reproduced on your diagram sheet. PQRS is to be enlarged by a scale factor of 3.



4.1 On the diagram sheet draw this enlargement and indicate the vertices $P'Q'R'S'$ and the co-ordinates of these vertices. (7)

4.2 Calculate the length of a side of both PQRS and $P'Q'R'S'$ and hence determine the relationship between the increased length of the sides and the increased area of the squares. Work in surd form. (6)
[13]

QUESTION 5

Throughout this question a calculator may not be used and all working must be clearly shown.

5.1 Simplify the following:

$$5.1.1 \quad \frac{-\tan x \cdot \sin(90^\circ - x)}{\sin(x)} - \frac{\tan(x - 180^\circ)}{\cos(90^\circ + x)} \quad (6)$$

$$5.1.2 \quad \frac{\cos 120^\circ}{\tan 225^\circ} \quad (4)$$

5.2 Consider the equation: $2 \cos^2 x - \cos x = 0$

5.2.1 Factorise the left hand side of the equation. (1)

5.2.2 Find the general solution to the equation. (5)

5.3 If $\sin 58^\circ = k$, then find the following:

5.3.1 $\sin 238^\circ$ (2)

5.3.2 $\cos 58^\circ$ (3)

[21]

QUESTION 6

Four learners are arguing about whose trigonometric expression best describes a particular situation.

Sipho	Ray	Lorraine	Vishnu
$\frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$	$1 - 2 \sin^2 \theta$	$1 - \sin \theta$	$2 \cos^2 \theta - 1$

6.1 They each substitute $\theta = 30^\circ$ into their expression. They all get the same value. What is it? (1)

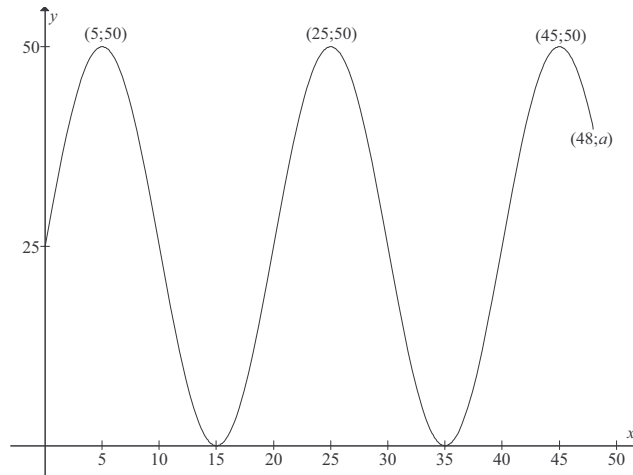
6.2 They each substitute $\theta = 50^\circ$. What value do they each get? (4)

6.3 Using your knowledge of trigonometric identities, show that three of the learners' expressions are exactly the same. (7)

[12]

QUESTION 7

You go down to the beach for a few days. As an experiment you place a metre stick in the sand to measure the height of the water. As the tide comes in, the height rises and then falls as the tide goes out. You record the heights for 48 hours – the height fluctuates between 0 cm and 50 cm. This is shown in the graph below:

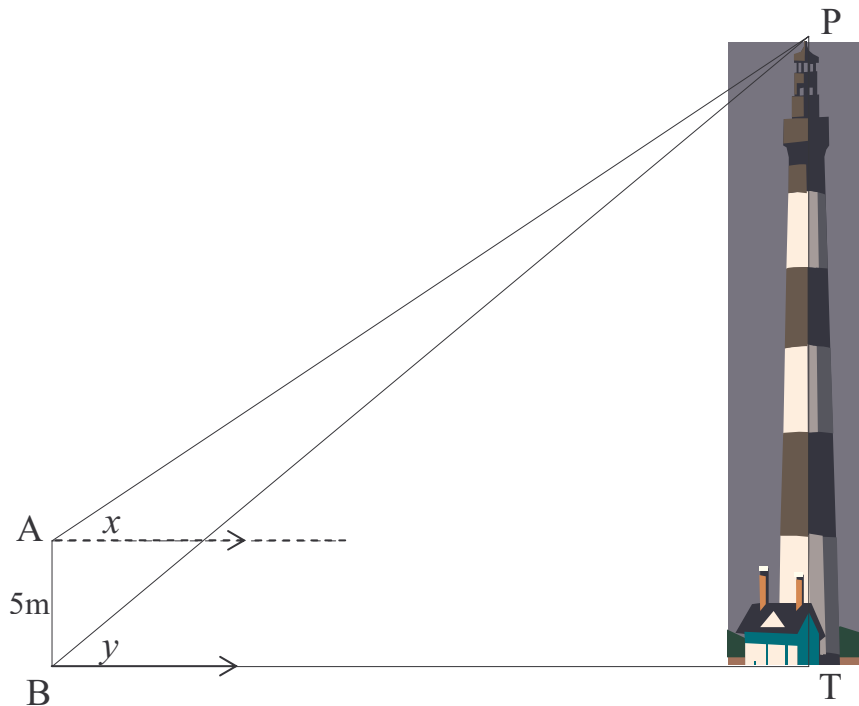


The equation for the height of the water is: $y = 25 \sin 18x + 25$ where y is the height of the water and x is the time in hours from the beginning of the experiment.

- 7.1 Calculate the height of the water when $x = 48$. (1)
- 7.2 Calculate the times when the height of the water is 10 cm by solving the equation $25 \sin 18x + 25 = 10$ for the 48 hour interval rounded off to the nearest hour. (6)
- [7]

QUESTION 8

While you are on the beach you stand at the base of a life-guards' tower, B, and measure the angle of elevation of a lighthouse, PT, to be y . From the top of the 5 m high life-guards' tower, A, the angle of elevation of P is x .



8.1 Find the size of \hat{APB} in terms of x and y . (2)

8.2 Show that $PB = \frac{5 \cos x}{\sin(y-x)}$ (3)

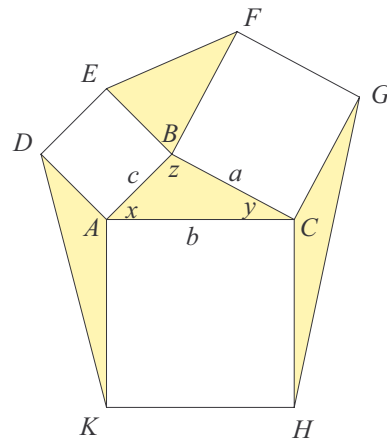
8.3 Hence show that $PT = \frac{5 \cos x \cdot \sin y}{\sin(y-x)}$ (2)

[7]

QUESTION 9

The diagram alongside looks very similar to that for the Theorem of Pythagoras, except that the central triangle is not right-angled.

On each side of a triangle (with angles x , y and z) a square has been drawn. The outer corners of the three squares have been joined as shown to make three more triangles.



- 9.1 Complete the formula: area of $\triangle ABC = \frac{1}{2}bc \dots\dots\dots$ (1)
 - 9.2 Show that area $\triangle DAK =$ area $\triangle ABC$. (3)
 - 9.3 State with reasons what will be the relationship between the areas of $\triangle DAK$ and $\triangle EBF$. (2)
- [6]**

QUESTION 10

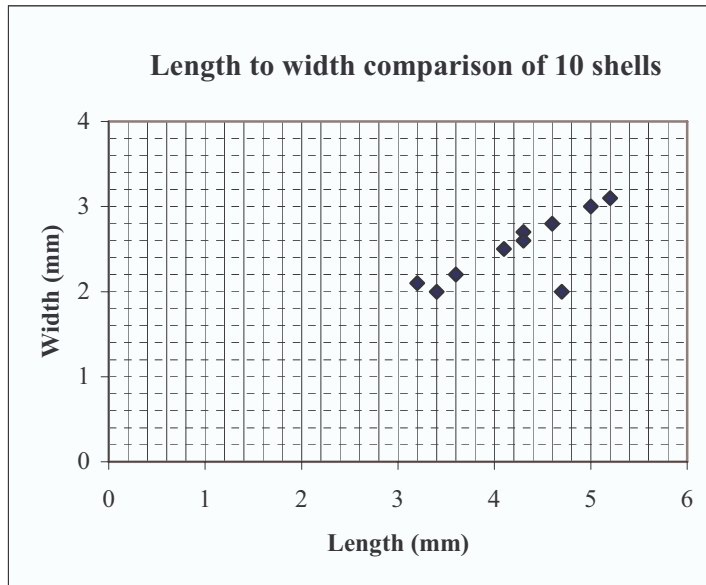
On the beach you find 10 shells and measure their lengths. These lengths are given in the table below.

Length (cm)	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
3,2		
3,6		
5,0		
4,1		
4,3		
4,7		
3,4		
5,2		
4,6		
4,3		

- 10.1 Calculate the mean length of these ten shells. (2)

10.2 Complete the copy of your table on your diagram sheet and use it to calculate the standard deviation of the length of your sample of shells. (6)

10.3 You also measure the widths of the ten shells. The graph of each shell's length plotted against its width is shown below. The graph is reproduced on the diagram sheet.



Draw an approximate line of best fit for the data and find its equation. (3)
[11]

QUESTION 11

A thousand pebbles from the beach are collected and their lengths are measured. The length of the smallest pebble is 1 mm and the largest is 95 mm. The lengths of the 1 000 pebbles are summarised in the table below:

Length of pebble (mm)	Number of pebbles	Cumulative frequency
$x < 20$	90	
$20 \leq x < 40$	240	
$40 \leq x < 60$	410	
$60 \leq x < 80$	200	
$80 \leq x < 100$	60	

11.1 Complete the cumulative frequency column in the copy of the table on your diagram sheet. (2)

11.2 Draw the ogive for this set of data using the graph paper on your diagram sheet. (5)

11.3 Find the median, upper quartile and lower quartile of the data using your graph. (3)
[10]

– End of Paper –