

CANDIDATE  
NAME

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CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**MATHEMATICS (SYLLABUS D)**

**4024/02**

Paper 2

**For Examination from 2018**

SPECIMEN PAPER

**2 hours 30 minutes**

Candidates answer on the Question Paper.

Additional Materials:      Geometrical instruments  
                                      Electronic calculator  
                                      Tracing paper (optional)

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name in the spaces at the top of this page.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

If working is needed for any question it must be shown below that question.

Essential working must be shown for full marks to be awarded.

**Electronic calculators should be used.**

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 100.

This document consists of **21** printed pages and **1** blank page.

- 1 (a) Zara owns a hairdressing salon.  
She buys a pack of 60 bottles of shampoo from a warehouse for \$240.  
She plans to sell the bottles of shampoo to her customers for \$5.50 each.

(i) Calculate the percentage profit Zara makes on each bottle she sells for \$5.50.

*Answer* .....% [2]

(ii) Zara sells 45 bottles at \$5.50 each then sells the rest with a 20% discount.

Calculate the total profit she makes selling all 60 bottles.

*Answer* \$ ..... [2]

(iii) When the warehouse sells a pack of shampoo for \$240 it makes a profit of 15%.

Calculate the price paid for the pack of shampoo by the warehouse.

*Answer* \$ ..... [2]

(iv) Zara borrows \$2500 from a bank to make improvements to her salon.  
She is charged 4.5% per year compound interest.  
She pays the money back after 3 years.

Calculate the total amount Zara must pay to the bank.

Give your answer correct to the nearest cent.

*Answer* \$ ..... [3]

- (b) Zara can exchange dollars (\$) for pounds (£) at the rate  $\$1 = \text{£}0.64$  .  
She can exchange dollars (\$) for euros (€) at the rate  $\$1 = \text{€}0.78$  .

Complete the statement to show the exchange rate between pounds and euros.

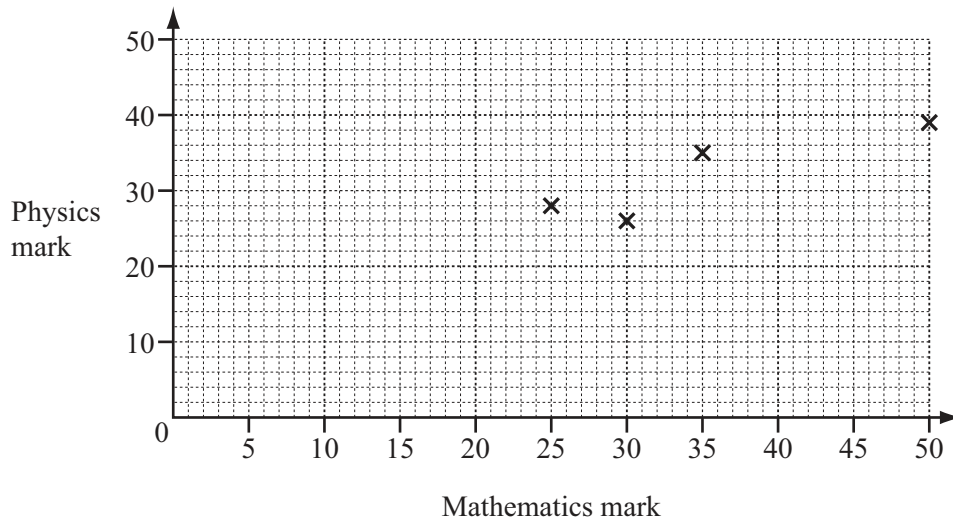
Exchange rate
£1 = €.....

[2]

- 2 The table shows the test marks in mathematics and physics for 10 students.

Mathematics mark	30	50	35	25	5	39	48	40	10	15
Physics mark	26	39	35	28	9	37	45	33	16	12

- (a) (i) On the grid, complete the scatter diagram to show the mathematics and physics marks for the 10 students. The first four points have been plotted for you.



[2]

- (ii) What type of correlation does your scatter diagram show?

Answer ..... [1]

- (iii) Draw a line of best fit on the grid. [1]

- (iv) Ann missed the physics test but scored 22 marks in the mathematics test. Use your line of best fit to estimate a possible physics mark for Ann.

Answer ..... [1]

- (b) Find the range of marks in the mathematics test.

Answer ..... [1]

- (c) Show that the mean physics mark for the 10 students is 28.

[1]

- (d) Two new students do the physics test. They both score the **same** mark.  
The mean physics mark for the 12 students is 31.

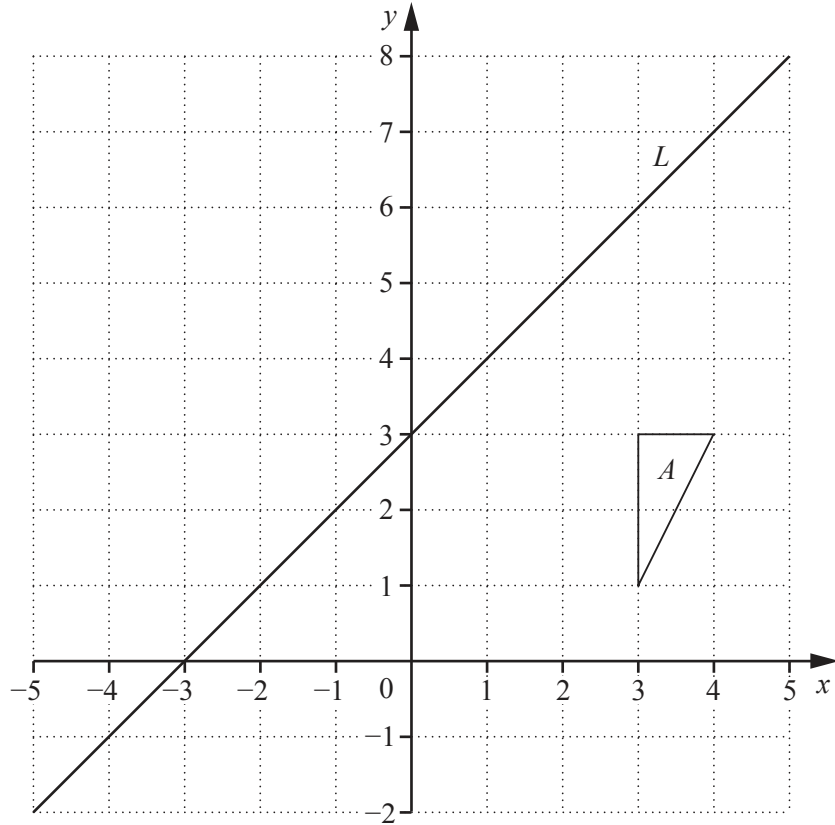
Calculate the physics mark for the new students.

*Answer* ..... [3]

- (e) Two of the original 10 students are chosen at random.

Work out the probability that **both** students scored less than 20 in the mathematics test.

*Answer* ..... [2]



The grid shows triangle  $A$  and line  $L$ .

- (a) (i) Triangle  $A$  is mapped onto triangle  $B$  by a reflection in line  $L$ .

Draw and label triangle  $B$  on the grid.

[2]

- (ii) Triangle  $A$  is mapped onto triangle  $C$  by a clockwise rotation of  $90^\circ$ , centre  $(0, 3)$ .

Draw and label triangle  $C$  on the grid.

[2]

- (iii) Triangle  $C$  is mapped onto triangle  $D$  by a reflection in line  $L$ .

Describe the **single** transformation that maps triangle  $B$  onto triangle  $D$ .

Answer .....

..... [3]

- (b) The line  $P$  is parallel to line  $L$  and passes through the point  $(0, 5)$ .

Find the equation of line  $P$ .

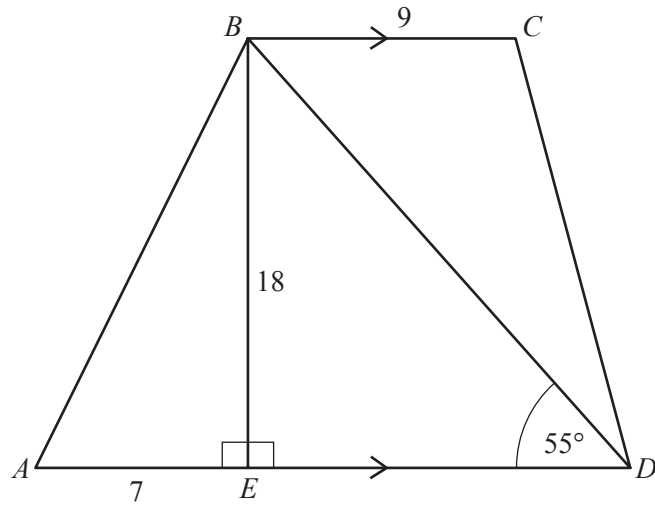
*Answer* ..... [2]

- (c) The line  $R$  is perpendicular to line  $L$  and passes through the origin  $(0, 0)$ .

Find the equation of line  $R$ .

*Answer* ..... [1]

- 4 (a)  $ABCD$  is a trapezium with  $BC$  parallel to  $AD$ .



$E$  is the point on  $AD$  such that  $BE$  is perpendicular to  $AD$ .  
 $\hat{BDA} = 55^\circ$ ,  $AE = 7$  cm,  $BE = 18$  cm and  $BC = 9$  cm.

Calculate

- (i)  $\hat{BAE}$ ,

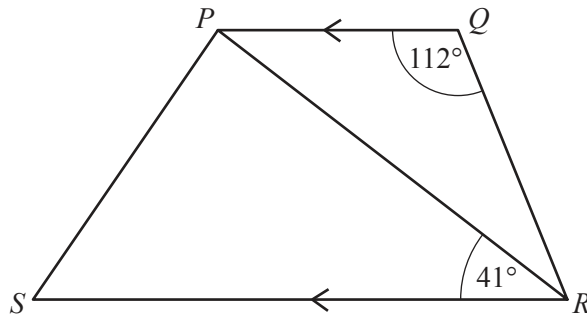
Answer  $\hat{BAE} = \dots\dots\dots$  [2]

- (ii) the area of the trapezium  $ABCD$ .

Answer  $\dots\dots\dots$   $\text{cm}^2$  [4]



(b)



$PQRS$  is another trapezium.

$\hat{PQR} = 112^\circ$  and  $\hat{PRS} = 41^\circ$ , each measured correct to the nearest degree.

Find the smallest possible value of  $\hat{QRP}$ .

Answer  $\hat{QRP} = \dots\dots\dots$  [2]

5 (a) (i) Write 84 as a product of its prime factors.

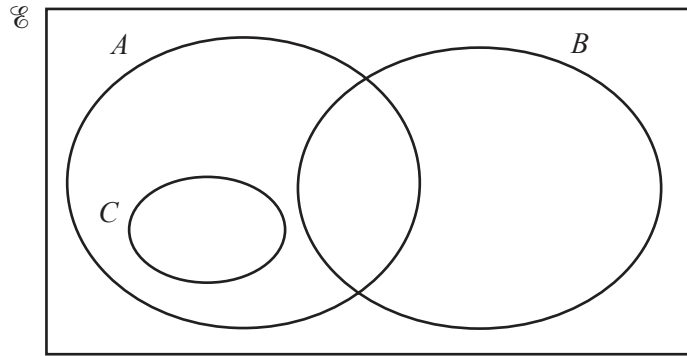
Answer ..... [1]

(ii)  $N$  is a two-digit number.  
The lowest common multiple (LCM) of 84 and  $N$  is 504.

Find  $N$ .

Answer  $N =$  ..... [2]

(b) The sets  $A$ ,  $B$  and  $C$  are shown in the Venn diagram.



$$U = \{ x : x \text{ is an integer, } 1 \leq x \leq 18 \}$$

$$A = \{ x : x \text{ is an even number} \}$$

$$B = \{ x : x \text{ is a multiple of } 5 \}$$

(i) Find  $n(A \cup B)$ .

Answer ..... [1]

(ii) (a) Given that  $A \cap B' \cap C' = \{2, 6, 14, 18\}$ , list the members of  $C$ .

Answer ..... [1]

(b) Describe the set  $C$  in words.

*Answer*  $C = \{ x : x \text{ is } \dots\dots\dots \}$  [1]

(c) A school offers piano lessons and flute lessons to a group of 50 children.

Of these children, 28 attend piano lessons

17 attend flute lessons

12 attend neither piano lessons nor flute lessons.

By drawing a Venn diagram, or otherwise, find the number of children who attend only the piano lessons.

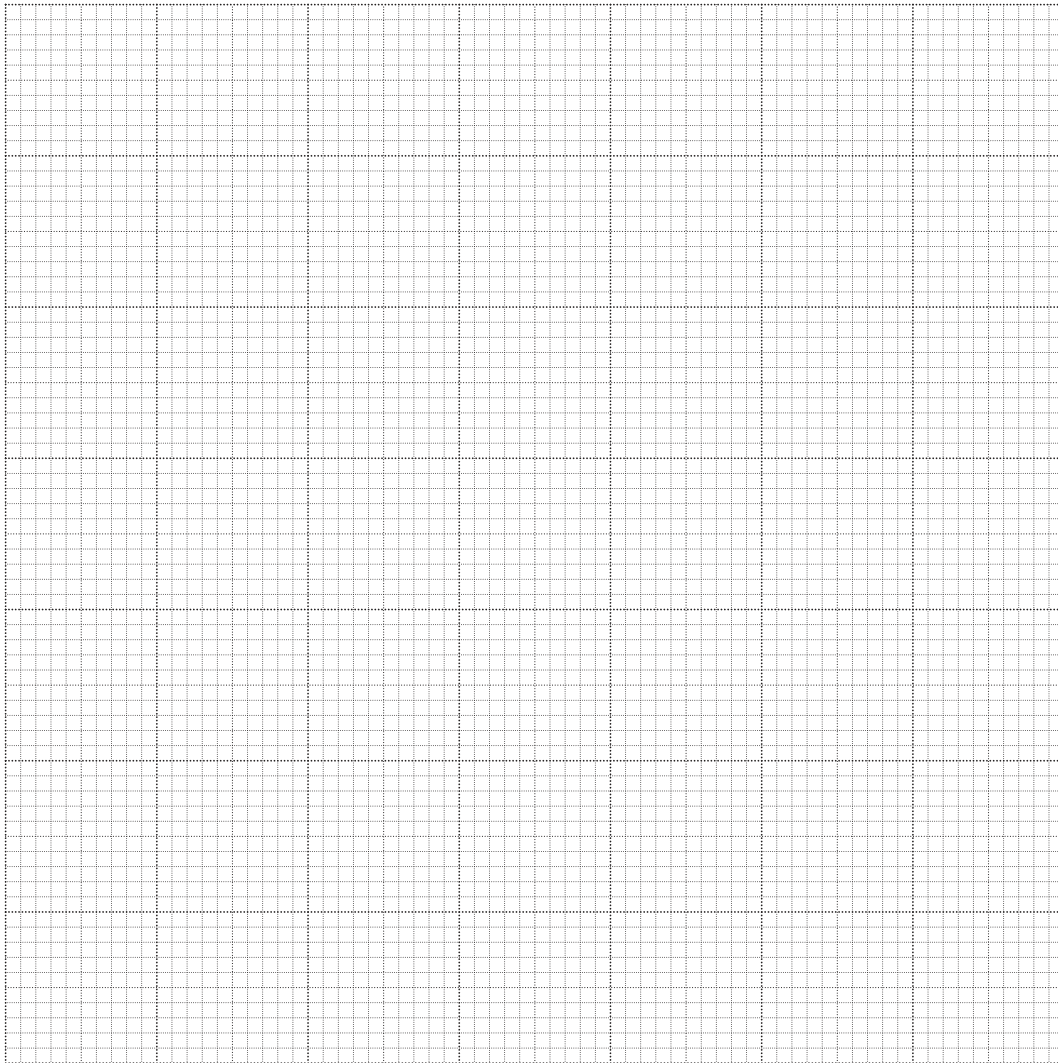
*Answer* ..... [2]

- 6 (a) The table shows some values of  $x$  and the corresponding values of  $y$  for  $y = 2x^3 - 3x^2 + 5$ .

$x$	-1.5	-1	-0.5	0	0.5	1	1.5	2
$y$		0	4	5	4.5	4	5	9

- (i) Complete the table. [1]
- (ii) Using a scale of 4 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $-1.5 \leq x \leq 2$ .  
Using a scale of 2 cm to represent 5 units, draw a vertical  $y$ -axis for  $-10 \leq y \leq 10$ .

Draw the graph of  $y = 2x^3 - 3x^2 + 5$  for  $-1.5 \leq x \leq 2$ .



[3]

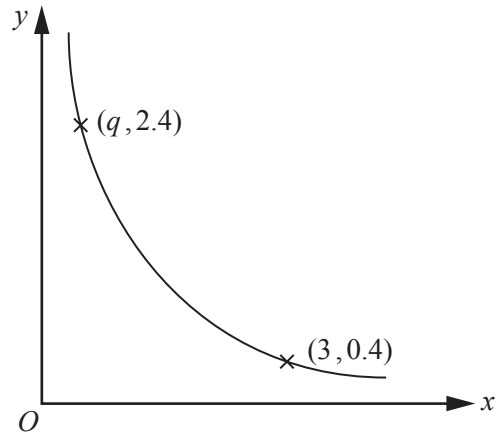
- (iii) Use your graph to estimate the gradient of the curve when  $x = 1.5$ .

*Answer* ..... [2]

- (iv) By drawing a suitable line on your graph, find the solution of the equation  $2x^3 - 3x^2 + 4 = 0$ .

*Answer*  $x =$ ..... [2]

(b)



The graph shows a sketch of the curve  $y = \frac{p}{x}$   
 Two points on the curve are  $(3, 0.4)$  and  $(q, 2.4)$ .

(i) Find  $p$  and  $q$ .

Answer  $p = \dots\dots\dots$

$q = \dots\dots\dots$  [2]

(ii) Calculate the gradient of the straight line joining the points  $(3, 0.4)$  and  $(q, 2.4)$ .

Answer  $\dots\dots\dots$  [2]

7 (a) Solve  $3(x - 5) = 5x - 7$ .

*Answer*  $x = \dots\dots\dots$  [2]

(b) Solve the simultaneous equations.

$$\begin{aligned}2x - y &= 6 \\4x + 3y &= -3\end{aligned}$$

*Answer*  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [3]

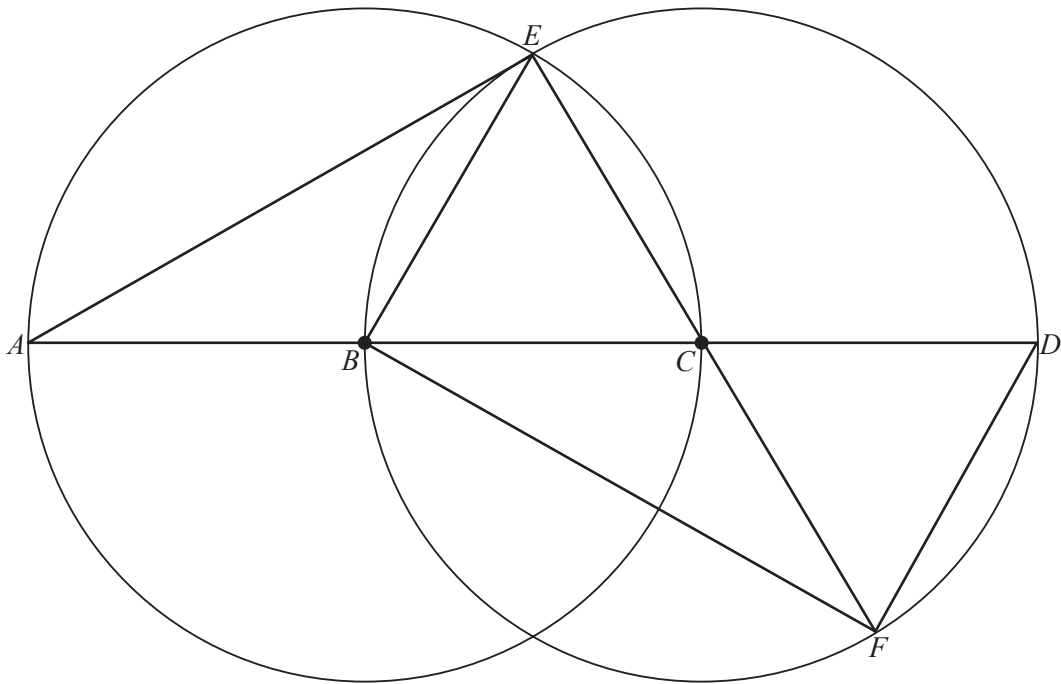
(c) Express as a single fraction in its simplest form  $\frac{7}{p+2} - \frac{4}{2p-3}$ .

*Answer* ..... [3]

(d) Simplify  $\frac{y^2-9}{2y^2-y-15}$ .

*Answer* ..... [3]

- 8 (a) The diagram shows two circles with equal radii.  
 $A, E$  and  $C$  are points on the circle with centre  $B$ .  
 $B, E, D$  and  $F$  are points on the circle with centre  $C$ .  
 $ABCD$  is a straight line.



- (i) Show that triangles  $AEC$  and  $FBE$  are congruent.

[3]

- (ii) State another triangle that is congruent to triangle  $AEC$ .

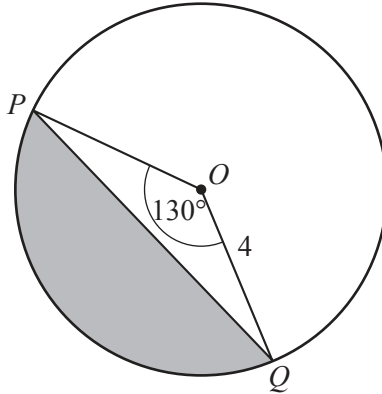
Answer Triangle ..... [1]

- (iii) Explain why  $EB$  is parallel to  $DF$ .

Answer .....  
 ..... [2]



- (b)  $P$  and  $Q$  are points on the circle centre  $O$  with radius 4 cm.  
 $\widehat{POQ} = 130^\circ$ .



- (i) Calculate the area of triangle  $POQ$ .

Answer .....  $\text{cm}^2$  [2]

- (ii) Calculate the area of the major segment, shown **unshaded** in the diagram.

Answer .....  $\text{cm}^2$  [3]

- 9 The distance between London and York is 320 km.  
A train takes  $x$  hours to travel between London and York.

(a) Write down an expression, in terms of  $x$ , for the average speed of the train in km/h.

*Answer* ..... km/h [1]

- (b) A car takes  $2\frac{1}{2}$  hours longer than a train to travel between London and York.  
The average speed of the train is 80 km/h greater than the average speed of the car.

Form an equation in  $x$  and show that it simplifies to  $2x^2 + 5x - 20 = 0$ .

[3]

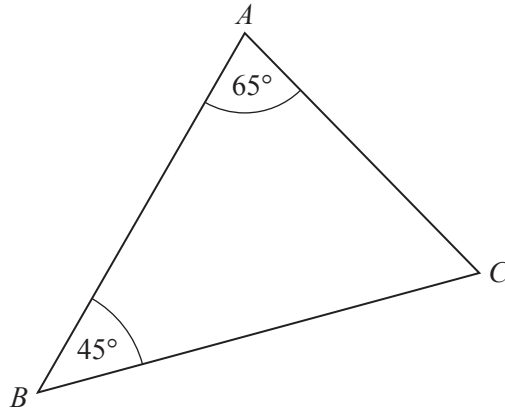
- (c) Solve the equation  $2x^2 + 5x - 20 = 0$ , giving your answers correct to 2 decimal places.

*Answer*  $x = \dots\dots\dots$  or  $\dots\dots\dots$  [3]

- (d) Hence find the average speed of the car correct to the nearest km/h.

*Answer*  $\dots\dots\dots$  km/h [2]

10 (a)



In triangle  $ABC$ ,  $\hat{ABC} = 45^\circ$  and  $\hat{BAC} = 65^\circ$ .  
 $AC$  is 5 cm shorter than  $BC$ .

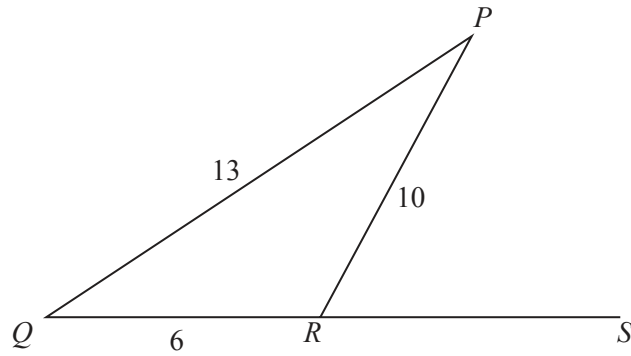
(i) Show that  $BC = \frac{5 \sin 65}{\sin 65 - \sin 45}$ .

[3]

(ii) Find the length of  $BC$ .

Answer  $BC = \dots\dots\dots$  cm [1]

(b)



In triangle  $PQR$ ,  $PQ = 13$  cm,  $QR = 6$  cm and  $RP = 10$  cm.  
 $QR$  is produced to  $S$ .

(i) Find the value of  $\cos \hat{P}RQ$ , giving your answer as a fraction in its simplest form.

Answer ..... [3]

(ii) Hence write down the value of  $\cos \hat{P}RS$ .

Answer ..... [1]

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