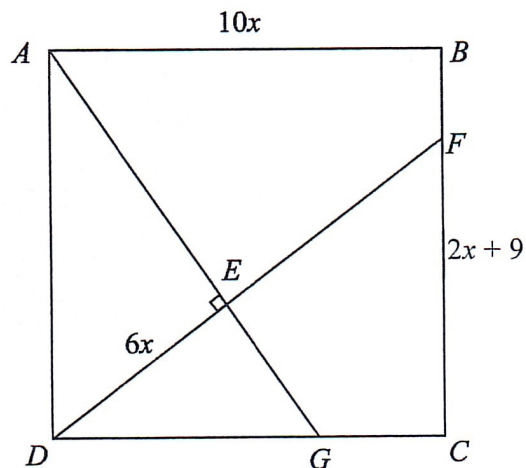


- 1 (a) A motorist travelled a journey of 330 km from Singapore to Kuala Lumpur at an average speed of v km/h. Write down an expression for the time, in hours, that he took for the journey.
- (b) On his return journey from Kuala Lumpur to Singapore, his average speed was reduced by 15 km/h due to heavy traffic flow. Write down an expression for the time, in hours, that he took for the return journey.
- (c) Given that the difference between these two times was 44 minutes, form an equation in v , and show that it reduces to $v^2 - 15v - 6750 = 0$.
- (d) Solve the equation $v^2 - 15v - 6750 = 0$. Hence, calculate, correct to the nearest minute, the total time that the motorist spent travelling.
- 2 In the diagram, $ABCD$ is a square of side $10x$ cm. AG meets DF at E . $DE = 6x$ cm, $CF = 2x + 9$ cm, $\angle AED = 90^\circ$ and the area of $ABFE$ is 103 cm^2 .
- (a) Form an equation in x and show that it reduces to $66x^2 - 45x - 103 = 0$.
- (b) Solve the equation, giving your answers correct to 2 decimal places.
- (c) Hence calculate the area of triangle ADE .

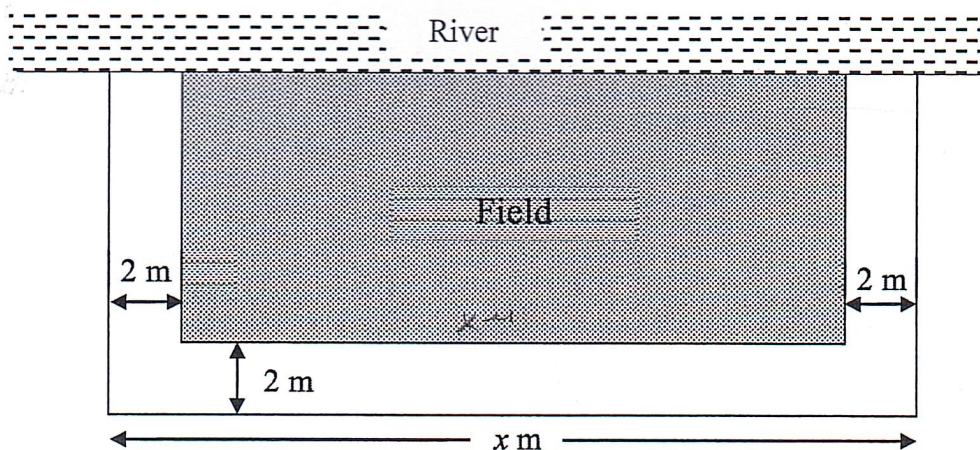


- 3 A tank can be filled with water by a large pipe in x hours.
- (a) Express in terms of x , the fraction of the tank occupied by water if the large pipe is turned on for one hour.

A smaller pipe alone takes six hours more than the large pipe to fill the tank.

- (b) Express in terms of x , the fraction of the tank occupied by water if the smaller pipe alone is turned on for one hour.
- (c) Given that the tank can be filled by both pipes together in $4\frac{1}{2}$ hours, form an equation in x and show that it can be simplified to $x^2 - 3x - 27 = 0$.
- (d) Solve the equation, giving the solutions correct to two decimal places.
- (e) Calculate the percentage of the tank that will be filled if the large pipe alone is turned on for 3 hours, giving your answer correct to one decimal place.

- 4 A rectangular piece of land is bounded on one side by a straight river, and the other sides by a fence whose total length is 248 m. The land consists of a rectangular field and a concrete path of width 2 m along 3 sides of the field as shown in the diagram. The length of the side of the land parallel to the river is x m and the area of the field is 5000 m^2 .

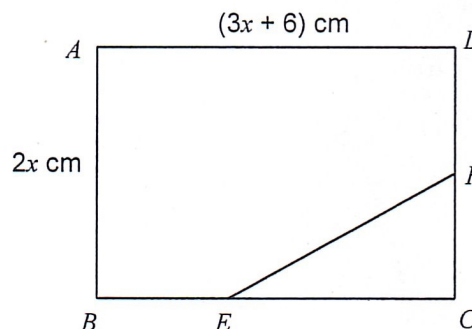


- (a) Write down an equation in terms of x and show that it reduces to $x^2 - 248x + 10976 = 0$.
- (b) Solve the equation and hence find the possible dimensions of the rectangular field.

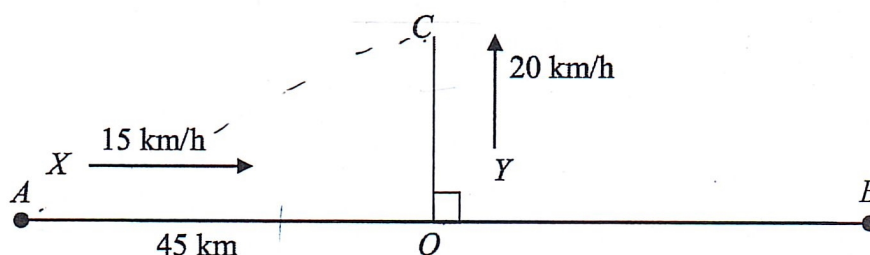
- 5 Mrs Tong bought a number of scarves for \$576, of which six of them were torn. The cost price of each scarf is \$ x , and she sold the rest at \$7 more than the cost price per scarf. Mrs Tong gained \$74 in the whole transaction.
- (a) Find, in terms of x , an expression for
 - (i) the number of scarves bought,
 - (ii) the number of scarves sold.
 - (b) Form an equation in x and show that it simplifies to $3x^2 + 58x - 2016 = 0$.
 - (c) Solve the equation $3x^2 + 58x - 2016 = 0$.
 - (d) Hence find the number of scarves sold.
- 6 Mr Tan buys petrol at a petrol station. Last week, he paid \$50 for x litres of Regular petrol. His sister paid \$45 for Premium petrol that cost 20 cents more per litre and obtained 10 litres less of petrol.
- (a) Write down, in terms of x , an expression for
 - (i) the price per litre of Regular petrol,
 - (ii) the price per litre of Premium petrol.
 - (b) Write down an equation which x must satisfy and show that it reduces to $x^2 + 15x - 2500 = 0$.
 - (c) Solve the equation and find, the price per litre of Regular petrol.
 - (d) If the petrol station offers a discount of 12% for Regular petrol this week, how much did Mr Tan save when he bought 35 litres of Regular petrol this week?
- 7 Two triangles, P and Q , each has an area of 100 cm^2 . The base of triangle P is x cm and that of triangle Q is $(x - 8)$ cm.
- (a) Write down an expression, in terms of x , for the perpendicular height of
 - (i) triangle P ,
 - (ii) triangle Q .
 - (b) Given that the perpendicular height of triangle Q is 15 cm longer than that of triangle P , form an equation in x and show that it simplifies to $3x^2 - 24x - 320 = 0$.
 - (c) Solve the equation and explain why you reject one of the answers.
 - (d) If triangle Q is a right-angled triangle, find the perimeter of triangle Q .

- 8 In the diagram, $ABCD$ is a rectangle in which $AB = 2x$ cm and $AD = (3x + 6)$ cm. Given that EC is twice BE and F is the midpoint of CD .
- Express the area of triangle ECF in terms of x .
 - If the area of the region $ABEFD$ is 110 cm^2 , form an equation in x and show it reduces to $x^2 + 2x - 22 = 0$.
 - Solve the equation $x^2 + 2x - 22 = 0$, giving the answers correct to two decimal places.

(BPGHS Prelim 02)



9



The diagram shows a road junction at O where AB is perpendicular to OC and $OA = 45$ km. A cyclist X travelled from A to B at a constant speed of 15 km/h . At the same time, another cyclist Y travelled from O to C at a constant speed of 20 km/h . The cyclists travelled for t hours where $t < 3$.

- Write down, in terms of t ,
 - the distance of X from O after t hours,
 - the distance of Y from O after t hours.
- Given that after t hours the cyclists were d km apart, show that $d^2 = 625t^2 - 1350t + 2025$.
Would the equation be the same if $t > 3$? Give your reasons clearly.
- Find the distance between the cyclists 50 minutes after the start.
- Show that when the two cyclists were 40 km apart, the time taken by the cyclists satisfied the equation $25t^2 - 54t + 17 = 0$.

Solve this equation and hence, find the distances cyclist X was from O .

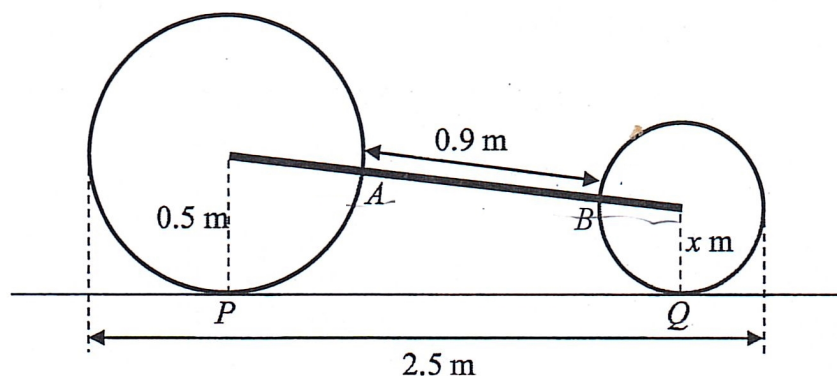
- 10 A cyclist travels from town A for 84 km at a constant speed of $(32 - x)$ km/h until he reaches a point B , where his bicycle chain breaks. He then walks the remaining 6 km from B to town C at a constant speed of $(7 - x)$ km/h.
- (a) Given that the total time taken for the whole journey from A to C is 4 hours, write down an equation in x and show that it reduces to $2x^2 - 33x + 58 = 0$.
 - (b) Solve the equation $2x^2 - 33x + 58 = 0$.
 - (c) Find the time the cyclist would have taken if he had completed the whole journey by bicycle at the original constant speed.
- 11 A motorboat can sail at a constant speed of x km/h in still water. When it sails with the current in a river, its speed is increased by $3\frac{1}{2}$ km/h and when it sails against the current, its speed is decreased by $3\frac{1}{2}$ km/h. The boat sails from village A to village B against the current and from village B to village C with the current on its way. Given that the distance from village A to village B is 12 km, that from village B to village C is 9 km and that the total time taken for the whole journey of 21 km is 75 minutes,
- (a) write down expressions, in terms of x , for the time taken by the boat to travel from
 - (i) village A to village B ,
 - (ii) village B to village C ,
 - (b) form an equation in x and show that it reduces to $20x^2 - 336x = 413$,
 - (c) solve the above equation giving your answer correct to 2 decimal places and state the time taken for the boat to travel from village B to village C , giving your answer correct to the nearest minute.
- 12 Two buildings, Angsana Building and Bonsai Building, stand on the same level ground. Each of the x storeys of the Angsana Building has a height of $\frac{2}{15}x$ metres. Bonsai Building has $(x + 7)$ storeys altogether with a height of $\frac{x}{10}$ metres each except for the first storey which is of height $4\frac{4}{5}$ metres.
- (a) Write down and simplify, in terms of x , an expression for the height of the two buildings respectively.
 - (b) If the two buildings have the same height, form an equation in x and show that it simplifies to $x^2 - 18x - 144 = 0$.
 - (c) Solve this equation.
 - (d) If the government regulates that the maximum height of any building is 94.2m, by how much does the height of the buildings fall short of this maximum height?

- 13 A solid cuboid has a base of dimensions $(8 - x)$ cm by $(x + 4)$ cm and height 1 cm.
- (a) (i) Show that the volume of the cuboid, V , in cm^3 , is given by $V = 32 + 4x - x^2$. Hence show that $V = 36 - (x - 2)^2$.
- (ii) Find the dimensions of the cuboid if the cuboid has the maximum possible volume.
- (iii) Find the dimensions of the cuboid if it has a volume of 20cm^3 .
- (b) (i) Find an expression, in terms of x , for the total surface area of the cuboid.
- (ii) If the total surface area is 40 cm^2 , find the volume of the cuboid.

- 14 The diagram below shows the positions of the rear and the front wheels of a steam-roller. The rear wheel has a radius of 0.5 m while the front wheel has a radius of x m ($0 < x < 0.5$). The length of the steam-roller measured from the edges of the wheels from the rear to the front is 2.5 m. AB , of length 0.9 m, is part of a metallic shaft that connects the axles of the 2 wheels which touch the ground at P and Q respectively.

Express the length of PQ , in metres, in terms of x . Form an equation in x and show that it reduces to $x^2 - 7.8x + 2.29 = 0$.

Solve the equation. Hence, state the radius of the front wheel, in metres, to 2 decimal places.



- 15 An autonomous cleaning robot at Changi Airport Terminal 4 can perform two functions, either floor-scrubbing or vacuuming.
- (a) The robot can vacuum $x\text{ m}^2$ of the floor in 10 minutes. Write down an expression, in terms of x , for the time taken, in seconds, to vacuum 1 m^2 of the floor.
- (b) In 10 minutes, the robot covers 2 m^2 less when scrubbing compared to vacuuming. Write down an expression, in terms of x , for the time taken, in seconds, to scrub 1 m^2 of the floor.
- (c) The robot takes 3 seconds longer to scrub 1 m^2 of the floor.
- (i) Write down an equation in x and show that it reduces to $x^2 - 2x - 400 = 0$.
- (ii) Solve the equation $x^2 - 2x - 400 = 0$ and hence find the area of the floor covered by the robot in 10 minutes when performing the vacuum function. Give your answer(s) correct to 1 decimal place.