

## Mathematics II

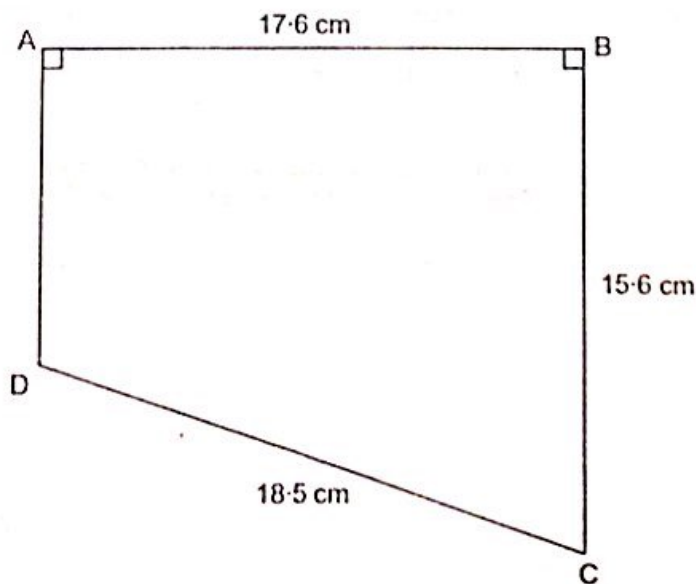
1½ hours

You are expected to use a calculator in this paper.

All working should be clearly shown.

You should attempt all the questions, in any order you like.

- 1 a In Ben's school, lessons last 55 minutes. Ben calculates that he spends 26 hours and 35 minutes in lessons each week. How many lessons are there in each week?
- b On Monday, Ben starts school at 8:55 a.m. and finishes at 4:10 p.m. He has six lessons on Monday. How long does he spend in school on Monday when he is not in lessons?
- 2 a Tim has a large barn full of potatoes. Each week, he eats 9% of the potatoes remaining in his barn at the start of the week. What percentage of the original quantity of potatoes is left at the end of the eighth week?
- b Tim also has a large barn full of turnips. Each week, he eats  $n\%$  of the turnips remaining in his barn at the start of the week. At the end of the eighth week, 61% of the original quantity of turnips is left. What is the value of  $n$ ?
- 3 a Simplify  $3(x-2) - 2(x-3)$ .
- b Multiply  $\frac{x}{3}$  by 6.
- c What would you have to add to  $\frac{x}{2}$  to get  $2x$ ?
- d Solve the equation  $\frac{8}{x} = \frac{x}{2}$ .
- 4 In the diagram, ABCD is a trapezium with right angles at A and B.  $AB = 17.6$  cm,  $BC = 15.6$  cm and  $CD = 18.5$  cm. Find the area of trapezium ABCD.



- 5 An amateur pyromaniac is making gunpowder out of saltpetre, charcoal and sulphur. He mixes these in the ratio 60% saltpetre, 25% charcoal and 15% sulphur by weight. He uses 22.5 kg of charcoal.
- How much saltpetre and sulphur does he use?  
He pays £2.45 per kilogramme for saltpetre and £3.20 per kilogramme for sulphur.
  - If he pays a total of £213.75 to make his gunpowder, what is the cost of charcoal per kilogramme?
- 6 The first General Election debate this year was on television from 8:30 until 10:00 in the evening. People who are registered to vote in the Election are called 'eligible voters'. At 9:00, 22.8% of eligible voters were watching the debate. In fact, 9.69 million eligible voters were watching the debate at 9:00.
- How many eligible voters were there?  
The number of eligible voters watching the debate at 8:30 was less than this. Between 8:30 and 9:00, the number of eligible voters who were watching had increased by 27.5%.
  - How many eligible voters were watching the debate at the start?  
By 10:00, 19.0% of eligible voters were watching the debate.
  - By what percentage did the number of eligible voters watching the debate decrease between 9:00 and 10:00?
- 7
- Find the prime factorisation of 2012010.
  - The numbers  $a$ ,  $b$  and  $c$  are all between 100 and 200;  $a$  is the smallest of the three and  $c$  is the largest. The product  $a \times b \times c = 2012010$ .  
Find the values of  $a$ ,  $b$  and  $c$ .
  - Show carefully that there is only one possible answer to part b.

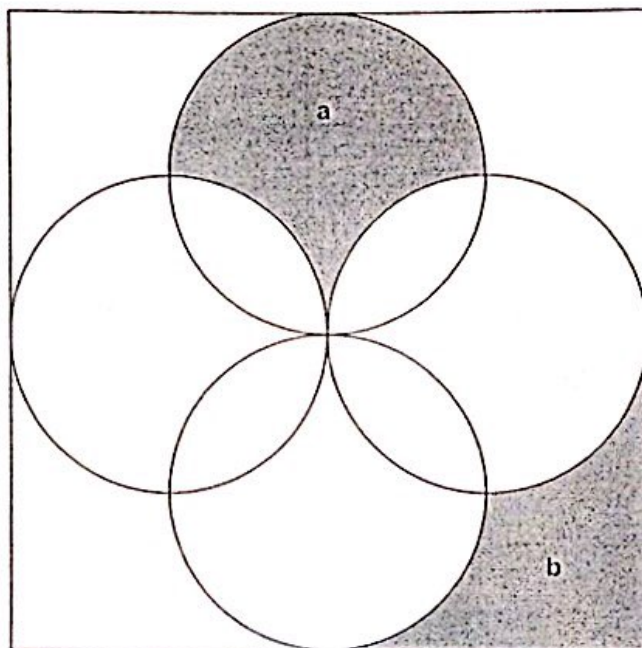
- 8
- A hollow cylindrical vessel is made of metal which has a constant thickness of 3 cm. The cylinder has an outside height of 28 cm and an outside diameter of 17 cm.  
What volume of metal is used to make the vessel?



The volume of a sphere is given by the formula  $V = \frac{4}{3}\pi r^3$ .

- A hollow spherical vessel is made of metal which has a constant thickness. The sphere has an outside diameter of 23 cm, and  $3317\text{cm}^3$  of metal is used to make the vessel.  
What is the thickness of metal in the vessel?
- 9 Every forty-four minutes, a train leaves Victoria for Brighton; every fifty-six minutes, a train leaves Victoria for Dover. The first Brighton train of the day and the first Dover train of the day leave Victoria simultaneously at 05:10.  
What is the only other time during the day when a train for Brighton and a train for Dover leave Victoria simultaneously?

- 10 In a Maths lesson on Monday lasting one hour, Alex and Ben solve 42 equations between them.
- a Alex does  $n$  of the equations. How many does Ben do?  
Alex practises solving equations that evening. On Tuesday, he is able to solve equations at twice the rate he could on Monday, but Ben solves them at the same rate as on Monday. On Tuesday, Alex and Ben solve equations for three quarters of an hour.
  - b Explain why Alex solves  $\frac{3}{4} \times 2n$  equations on Tuesday.
  - c How many equations does Ben solve?
  - d In fact, Alex and Ben solve 42 equations between them on Tuesday, as well. Write an equation for  $n$  and solve it.
- 11 The diagram shows how four circles of radius 2 cm fit symmetrically in a square.



Find the two shaded areas, marked **a** and **b**.