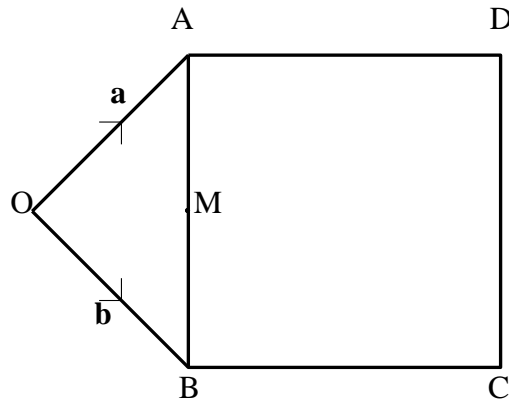
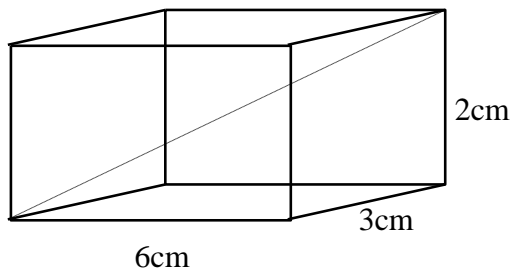


1. In the diagram below ABCD is a square and triangle OAB is right-angled at O with  $OA = OB$ . Relative to the origin O, A and B have position vectors **a** and **b** respectively.

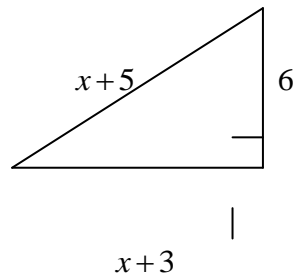


- (a) Express  $\overrightarrow{AB}$  in terms of **a** and **b**.  
 (b) If M is the mid-point of AB, express  $\overrightarrow{OM}$  in terms of **a** and **b** and hence or otherwise express  $\overrightarrow{OD}$  in terms of **a** and **b**.
- 2.



The edges of the above cuboid have lengths as shown.

- (a) Calculate the length of the space diagonal shown by the dotted line.  
 (b) Calculate the size of the angle between the space diagonal and the base.
3. A cube has space diagonals of length 12 cm.  
 Calculate the length of an edge, giving your answer as a surd in its simplest form.
4. Find algebraically the value of  $x$  in the right-angled triangle sketched below.



5. Simplify

(a)  $\frac{a^3 \times a^{-1}}{a^{-5}}$

(b)  $a^{-3}^{-1}$

(c)  $\sqrt{x}^6$

6. A doctor's travelling expenses, £ $C$ , are worked out as follows:

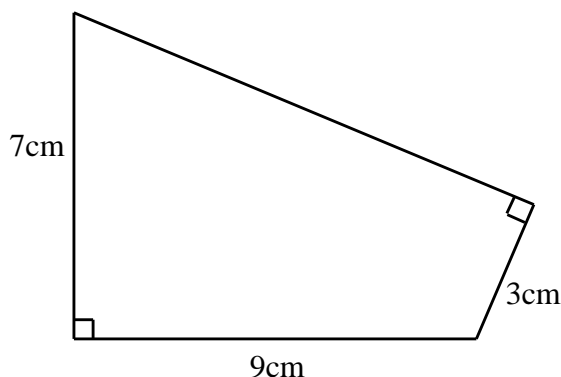
For journeys of 150 miles or less  $C = \frac{18N}{100}$

For journeys of more than 150 miles  $C = 27 + \frac{12(N-150)}{100}$ ,

where  $N$  is the number of miles travelled.

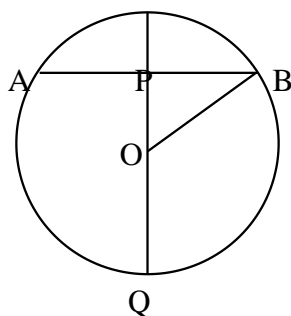
- (a) How much is she paid for a 90 mile journey?  
 (b) How much is she paid for a 216 mile journey?

7. What, in square centimetres, is the area of the quadrilateral sketched below?



8. The diagram below shows the circular cross-section of a large sewer with radius  $OB = 1.2$  metres. The surface of the effluent,  $AB$ , has length 2 metres.

- (a) Calculate the maximum depth of the effluent,  $PQ$ .  
 (b) What other depth of effluent would give a surface of length 2 metres? Explain your answer.



9. A ship is spotted at position R, which is on a bearing of  $315^\circ$  from a lighthouse L. The distance between R and L is 10 kilometres.  
 After the ship has travelled due west to position T, its bearing from the lighthouse is  $300^\circ$ .  
 How far has the ship travelled from R to T?

10. Simplify

(a)  $\frac{1}{a-1} - \frac{2}{a+1}, \quad a \neq \pm 1$

(b)  $\frac{3}{x^2} + \frac{2}{x^3}, \quad x \neq 0.$