**1.** A pebble is projected vertically upwards with speed $10{\cdot}5\ \text{ms}^{-1}$ from a point $A$ at the top of a cliff.

*(a)* Find the greatest height above $A$ reached by the pebble. [3]

*(b)* The pebble reached the bottom of the cliff 5 s after being projected. Calculate the height of the cliff. [3]

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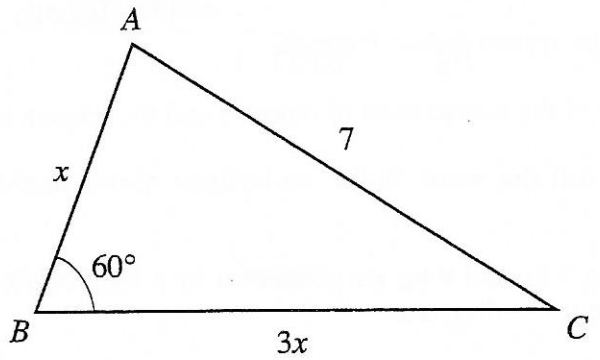
**2.** *(a)* Find all values of $x$ between 0° and 180° satisfying

$$\tan 3x = \sqrt{3}.$$ [4]

*(b)* Find all values of $\theta$ in the interval 0° to 360° satisfying

$$4\cos^2\theta - \cos\theta = 2\sin^2\theta.$$ [6]

**3.** The diagram below shows the triangle $ABC$ with $AB = x$ cm, $BC = 3x$ cm, $AC = 7$ cm and $\hat{ABC} = 60°$.




*(a)* Show that $x = \sqrt{7}$. [3]

*(b)* Find $\hat{ACB}$. [2]

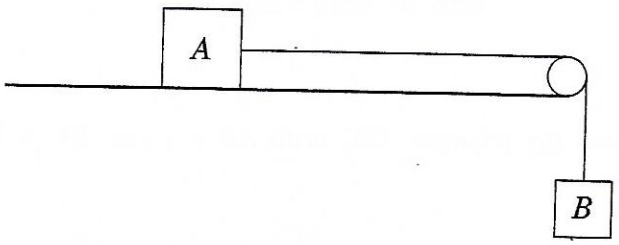
4. A car of mass 800 kg is travelling on a horizontal road. It experiences a resistance to motion which is constant throughout the journey. The car accelerates from rest under a constant tractive force of 300 N exerted by its engine. After 50 seconds, the car reaches a speed of $15\,ms^{-1}$.

(a) Determine the magnitude of the acceleration of the car. [3]

(b) Calculate the magnitude of the constant resistance to motion. [3]

(c) When the car reaches the speed of $15\,ms^{-1}$, the engine is switched off and the car is brought to rest by a constant braking force. The total distance covered by the car for the **whole** journey is 500 m. Find the constant force exerted by the brakes. [7]

5. The diagram shows an object $A$, of mass 6 kg, lying on a smooth horizontal table. The object $A$ is connected by means of a light inextensible string passing over a smooth pulley at the edge of the table to another object $B$, of mass 4 kg, hanging freely.

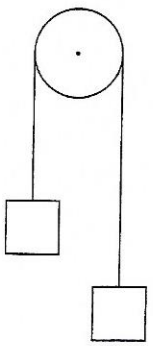



Initially, the system is held at rest with the string just taut. The system is then released.

(a) Find the magnitude of the acceleration of object $A$ and the tension in the string. [9]

(b) What assumption did the word 'light' underlined above enable you to make in your solution? [1]

6. Two particles of masses 7 kg and 9 kg are connected by a light inextensible string passing over a smooth pulley as shown in the diagram.



Initially the particles are held at rest with the string taut. The system is then released. Calculate

(a) the magnitude of the acceleration of each particle, [5]

(b) the tension in the string. [1]