USING PYTHAGORAS THEOREM – SOME CHALLENGING QUESTIONS

COURSE/LEVEL

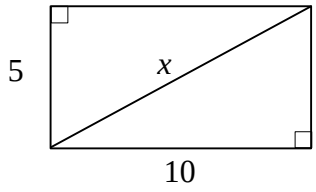
NSW Secondary High School Year 8 Mathematics

TOPIC

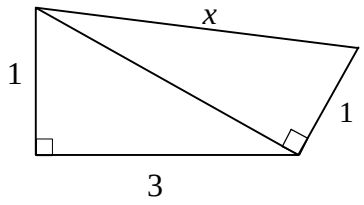
Pythagoras' Theorem

1 Find the value of x in these diagrams.

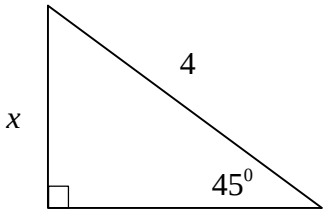
(a)



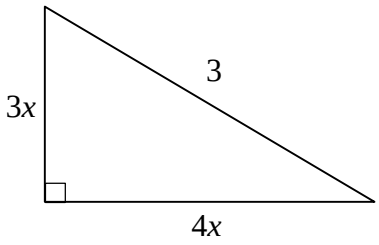
(b)



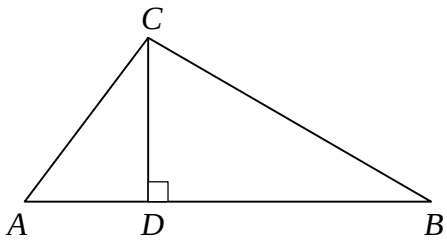
(c)



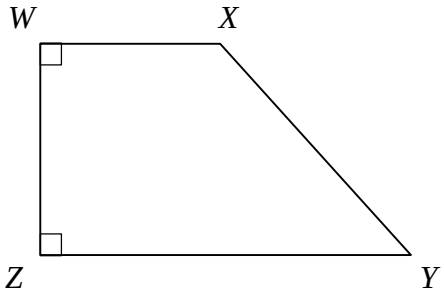
(d)



2 (a) Find the perimeter of triangle ABC given that $AC = 13$, $CD = 12$ and $BD = 16$.



(b) Find the perimeter of the trapezium $WXYZ$ if $WX = 7\ m$, $YZ = 13\ m$ and $ZW = 8\ m$.



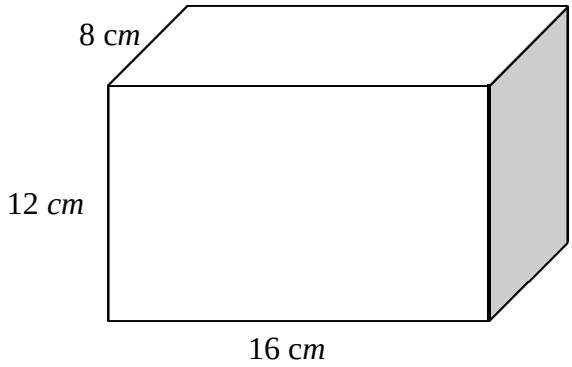
3 (a) Find the area of an equilateral triangle with 2 cm sides.

(b) Find the area of an equilateral triangle with 10 cm sides.

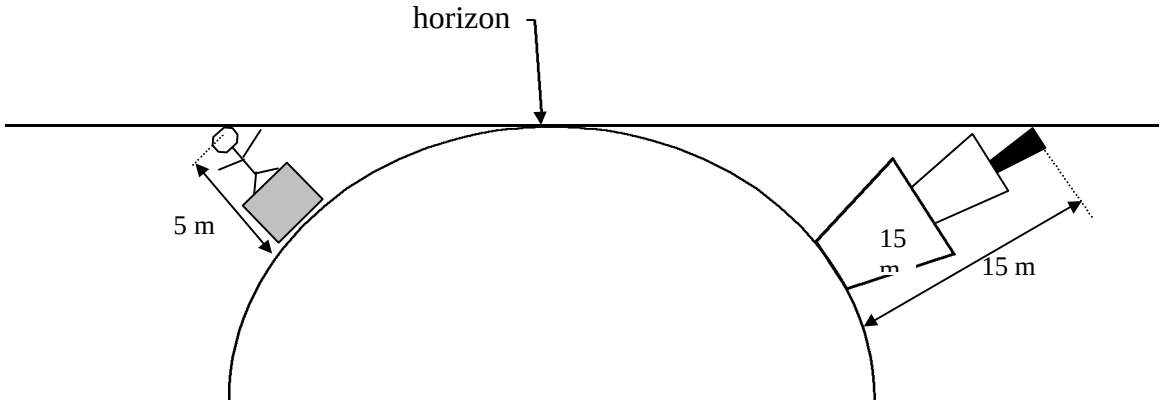
(c) Find the area of a regular hexagon which has 4 cm sides.

4 A 25 m ladder leans against a vertical wall. The foot of the ladder is 20 m from the base of the wall. If the foot is moved 13 m closer to the wall, how far does the top of the ladder move up the wall?

5 A pencil box, in the shape of a rectangular prism, measures 16 cm by 12 cm by 8 cm. Find the length of the longest pencil that would fit inside the box.



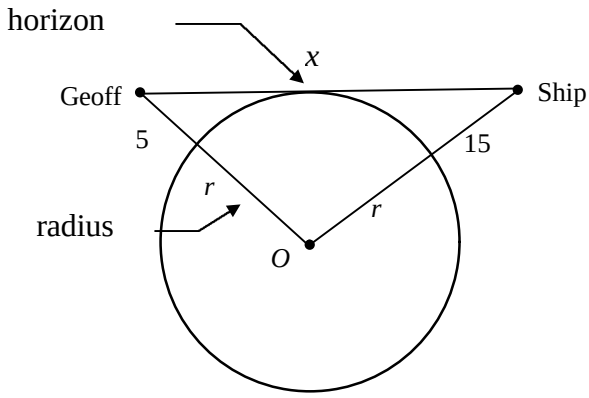
6 Looking over the horizon, Geoff observes the top of a ship as it approaches directly towards him. His eye level is 5 metres above sea level and the funnel of the ship is 15 metres above sea level.



Use the diagram on the right to find the distance, *x*, from Geoff to the ship.

r is the radius of the Earth, equal to 6400 kilometres.

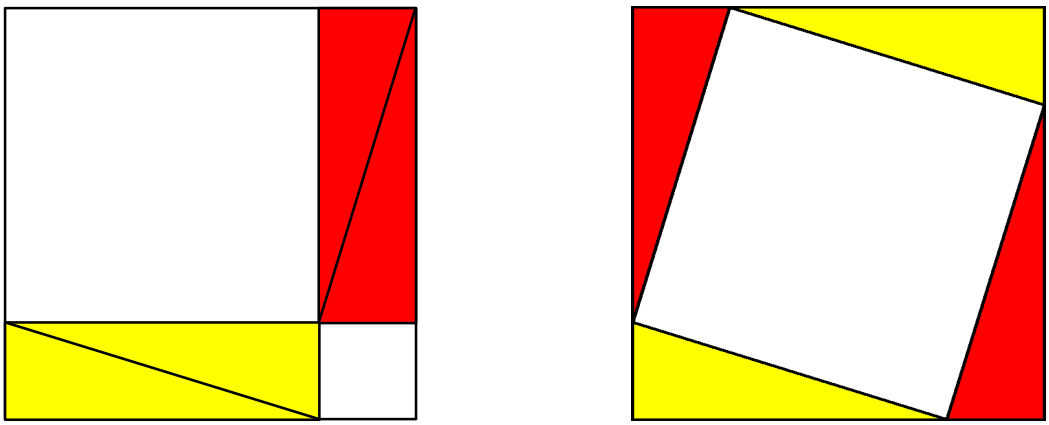
(Hint: find the distance from Geoff to the horizon and the distance from the ship to the horizon, and then add them together.)



7 A triangle is right-angled if the sides are $a = m^2 - n^2$, $b = 2mn$ and $c = m^2 + n^2$ where m and n are positive integers, and $m > n$.

Show that this is true by substituting into the equation $c^2 = a^2 + b^2$.

8 The following "picture" dates back to 200 B.C. and was created by an unknown Chinese author. Explain how it proves Pythagoras' Theorem.



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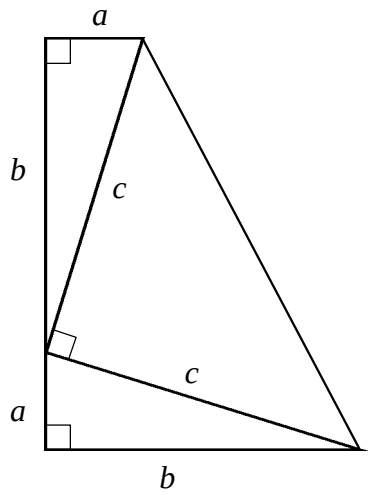

$$A = 2 \times \frac{1}{2}ab + \frac{1}{2}c^2 = \frac{1}{2}(a+b)^2$$

$$c^2 = a^2 + b^2$$

James A. Garfield was the 20th President of the United States. In 1876, he produced the above proof of Pythagoras' Theorem. In the proof, he gives two different expressions for A, the area of the trapezium, from which he deduces Pythagoras' Theorem. Fully explain the proof. In particular, explain how he derives the two expressions for A.