RADLEY

Scholarship Examination

MATHEMATICS

March 2019

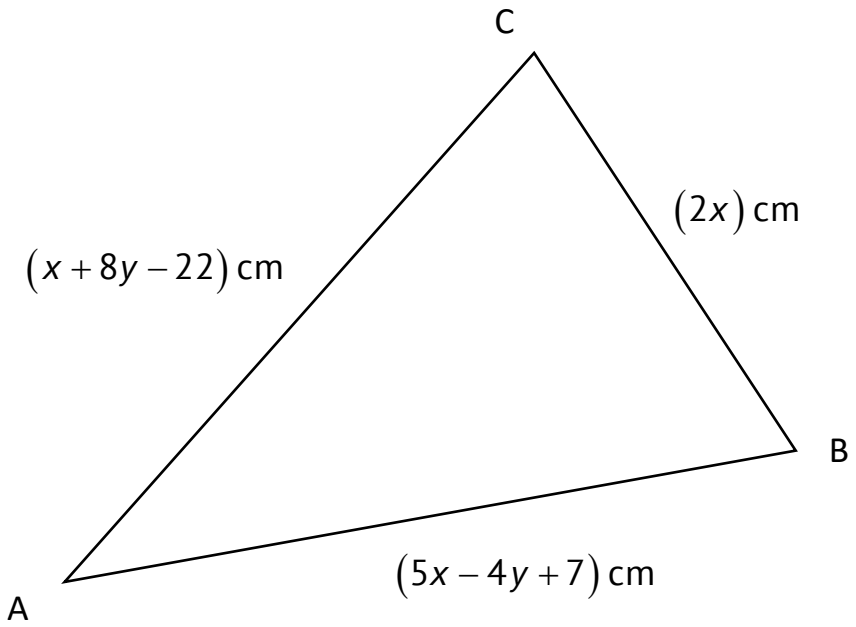
Time allowed – 1 hour

Show all working

Calculators can be used

Diagrams are not drawn to scale

1.



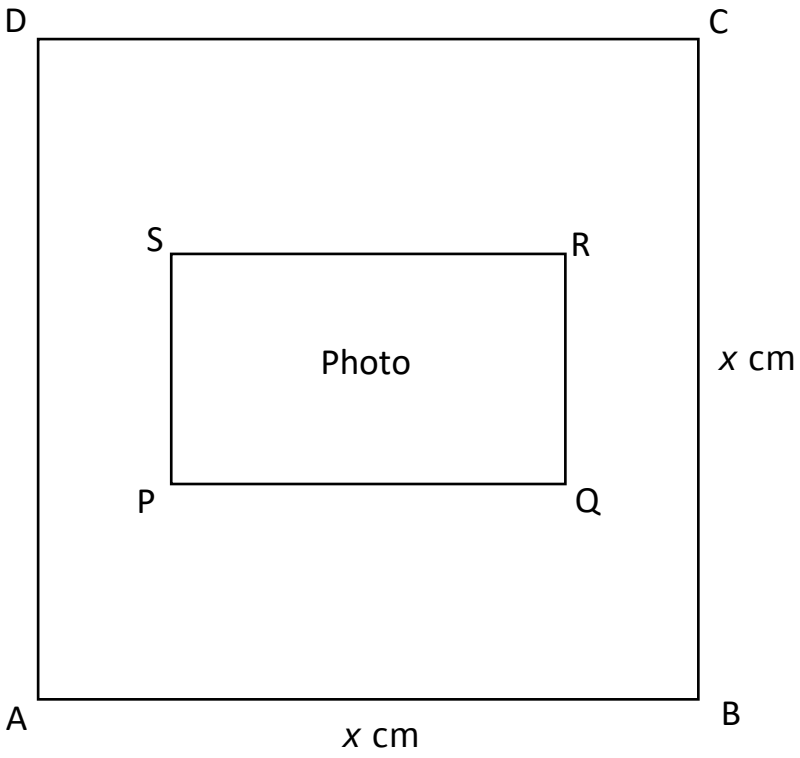
The diagram shows an isosceles triangle ABC in which AB = AC. The perimeter of the triangle is 18 cm. Lengths, as shown in the diagram are AB = $(5x - 4y + 7)$ cm, BC = $(2x)$ cm and AC = $(x + 8y - 22)$ cm.

a. Write down two equations connecting *x* and *y*, and solve them to find the values of *x* and *y*.

b. Calculate the area of the triangle.

2. The Warden and Sub-Warden each decide to walk from Radley to Oxford, a distance of 6 miles. They set out at the same time, and follow the same route, but the Warden walks twice as quickly as the Sub-Warden. When the Sub-Warden has three times as far remaining to walk as the Warden, how far is the Warden from Oxford?

3.



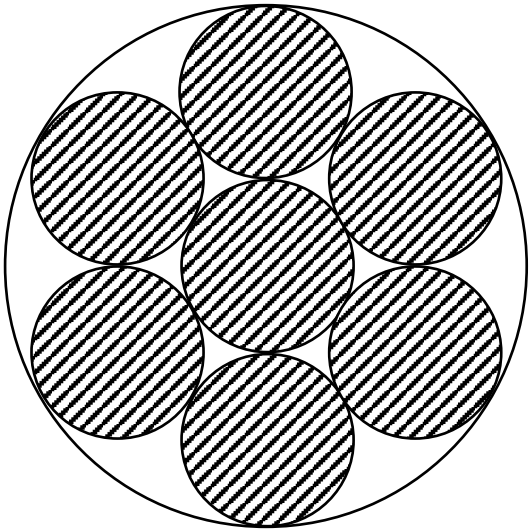
A rectangular photograph, PQRS, is to be mounted on a square card, ABCD, of side x cm. The width of the photograph is 5 cm less than the width of the card, and the length of the photograph is 12 cm less than the length of the card. The area of the photograph is half the area of the card.

a. Form an equation for x.

b. Work out the dimensions of the photograph.

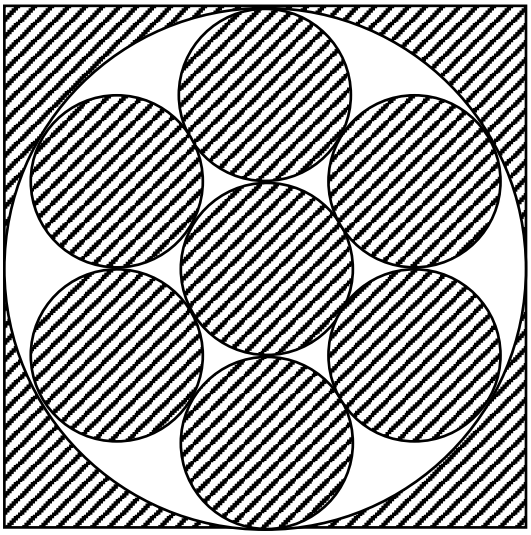
4

a.



The diagram above shows seven circles of equal radius which fit exactly into a larger circle. What is the ratio of the shaded area to the unshaded area?

b.



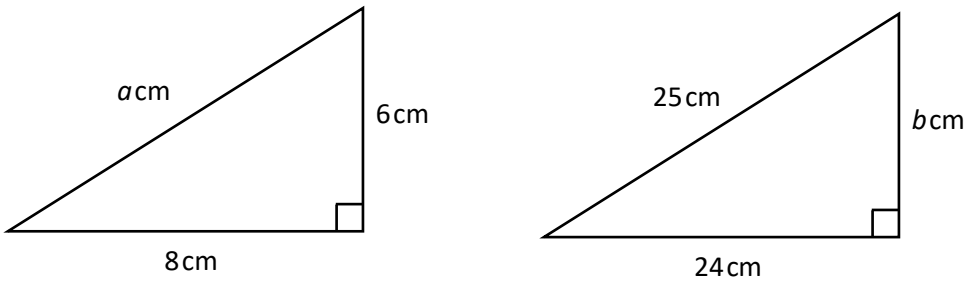
The large circle in part a fits exactly into a square as shown above. What is the ratio of the shaded area to the unshaded area?

5. a. Mr Juncker likes cognac. The 27-star brand that Mr Juncker prefers costs €125 per bottle. Mr Juncker's cognac allowance is €1200 per week. Fortunately, Mr Juncker's friend, Mr Macron, offers him a discount of 52%. How many bottles can Mr Juncker buy with his weekly allowance?

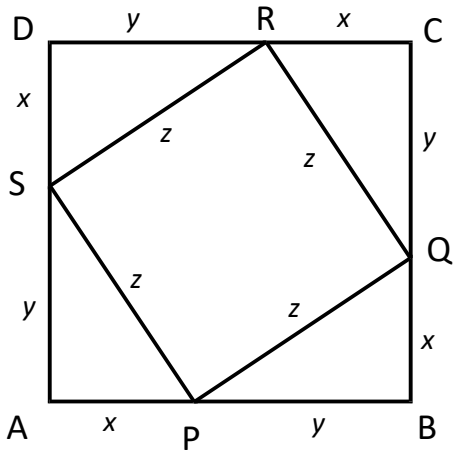
   b. At dinner one day, Mr Juncker spills his cognac on Mr Macron's friend, Mr Varadkar. Mr Macron withdraws his discount in protest. Always keen to please some people, Mrs Sturgeon offers Island of Scotland Malt as an alternative. In spite of Mrs Sturgeon's best efforts, Scotland still uses the pound, and the exchange rate is €1 = £0.89. Mr Juncker is very excited to discover that his weekly allowance of €1200 will buy him 48 bottles of Island of Scotland Malt. What is the price, in pounds, of Island of Scotland Malt?

   c. In his excitement, Mr Juncker over-celebrates, and falls down the steps on a plane in Poland. While in hospital, Mr Tusk offers Mr Juncker some specially heated Bitter Polish Vodka. Mr Tusk is not a cheerful man, and he tells Mr Juncker that his allowance will only buy him 65 bottles. This is because he has lost £39 billion, and has had to add a Brexit tax of 25%. How many bottles could Mr Juncker have bought before the Brexit tax?

6. a.



Use Pythagoras's Theorem to find the lengths of *a* and *b* in the right-angled triangles above.



b. The diagram shows a square, ABCD, of side $(x + y)$ cm.

Points P, Q, R and S divide the sides AB, BC, CD and DA respectively into lengths *x* and *y*, as shown. The square PQRS has sides of length *z* cm.

i. Write down an expression in terms of *x* and *y* for the area of the square ABCD.

ii. Write down an expression in terms of *z* for the area of the square PQRS.

iii. Write down an expression in terms of *x* and *y* for the area of the triangle PBQ.

iv. By putting a number in the box, complete the statement:

Area (ABCD) = (Area PQRS) + ☐ x Area (PBQ).

v. Hence prove Pythagoras's Theorem.