Entrance Scholarships

MATHEMATICS II

7th March 2013

Time allowed 1 hour

Show all working.

You may use a calculator

RADLEY

1. I invest £100 in an account that pays 5% compound interest.

   (a) How much is my investment worth after 1 year?

   (b) Explain why my investment is worth £110.25 after 2 years?

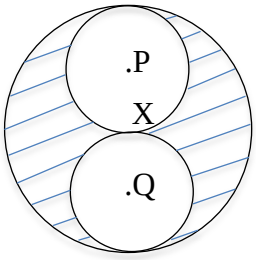
   My wife puts some money into the same account. At the end of the first year her investment is worth £254.10.

   (c) How much was her original investment?

   My aunt also puts some money into the same account. At the end of two years her investment is worth £3810.24

   (d) How much was her original investment?

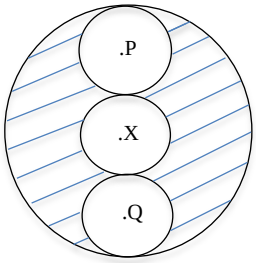
2. (a)



The diagram shows two circles of equal radius, centres P and Q, inside a larger circle. X is the centre of the larger circle, and is where the two smaller circles touch. Find the ratio

(shaded area) : (unshaded area)

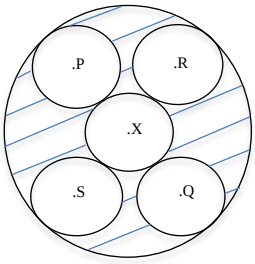
(b)



The two circles are now replaced with three smaller circles, of equal radius, centres P,X and Q, where X is dirctly above Q, and P is directly above X. Find the ratio

(shaded area) : (unshaded area)

(c)



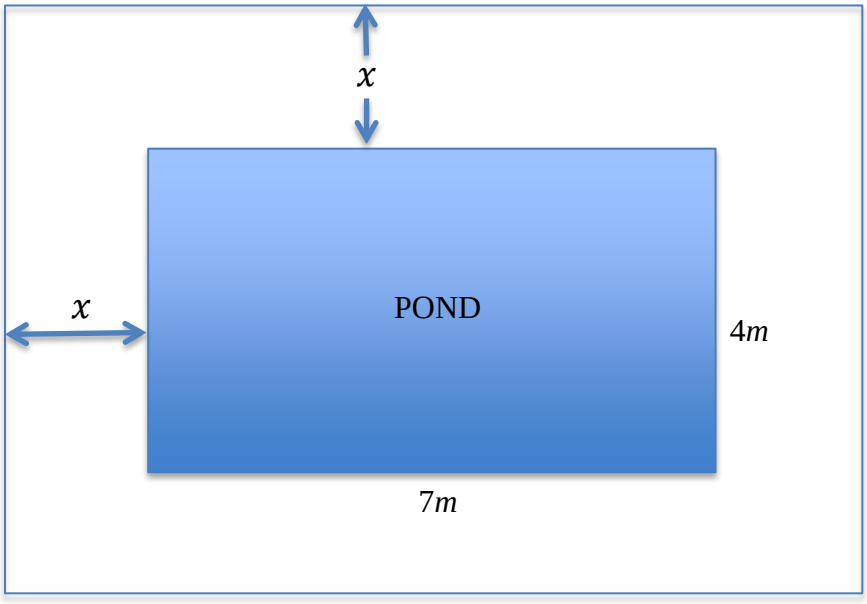
In this diagram, five circles of equal radius, centres P,X,Q,R and S are drawn inside the larger circle, as in the diagram above. Find the ratio

(shaded area) : (unshaded area)

3. A bag contains a mix of 20p pieces and 50p pieces. A 20p piece has a mass of 5 grams, and a 50p piece has a mass of 8 grams. The combined mass of all the coins is 269 grams, and their value is £14.

Use simultaneous equations to find the number of 50p pieces in the bag.

4.



A rectangular pond is 7 metres by 4 metres. It is surrounded by a path of width x metres. The area of the path is $42m^2$.

(a) Write down an expression, in terms of x, for the area of the path.

(b) Deduce that $2x^2 + 11x - 21 = 0$

(c) Hence find the width of the path.

5. Leaving your answers as fractions

(a) Calculate $\frac{1}{2} - \frac{1}{2^2}$

(b) Calculate $\frac{1}{3} - \frac{2}{3^2}$

(c) Calculate $\frac{1}{4} - \frac{3}{4^2}$

(d) Calculate $\frac{1}{5} - \frac{4}{5^2}$

(e) Calculate $\frac{1}{100} - \frac{99}{100^2}$

(f) Write down a formula that summarises all of the above calculations.

(g) Justify your formula.

6. In this question, all masses are integer values - ie every mass is a whole number of kilograms. The diagram shows how to weigh an object, x, using two fixed masses of 1kg and 6kg.

Since the scales are balanced, x must be 5kg.

(a) Show how you can measure all the masses from 1kg to 10 kg using just three fixed masses of 1kg, 3kg, and 6kg.

I now wish to measure all the masses from 1kg to 13kg using just three fixed masses.

(b) Given one of those masses is 1kg, find the other two.

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