RADLEY

Entrance Scholarships

MATHEMATICS II

March 2014

Time allowed: 1 hour

Show all working. You may use a calculator

1. I am looking for the best value when buying Fairy Liquid.

- A *small* bottle contains 383 ml and costs £1.34
- A *large* bottle contains 870 ml and costs £3.35

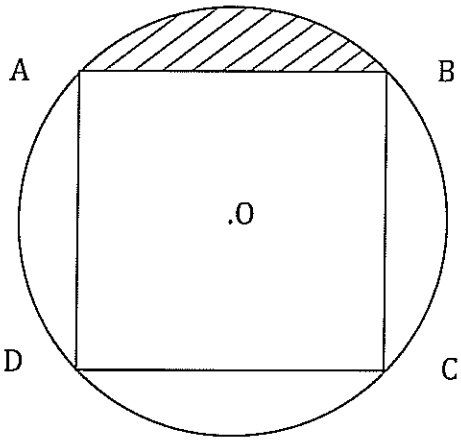
(a) Which of these represents the best value for money?

Later that week I see that some supermarkets are offering special offers on these same basic prices.

- At Waitbury if you buy two *large* you get a third *large* for free.
- At Sainsrose if you buy one *small* you get a second *small* at half price.

(b) Which of these is the best value for money?

2.



The diagram shows a square, ABCD, inside a circle. The circle has centre O, and A, B, C and D lie on the circle. The diagram is not to scale, and the square has sides of length 2 cm, ie AB = BC = CD = DA = 2 cm.

(a) Calculate the length of AC.

(b) Calculate the radius of the circle.

(c) Calculate the area of the circle.

(d) Calculate the area of the segment that is shaded in the diagram.

3. It takes Bela x seconds to open a bottle of wine, and y seconds to open a bottle of champagne. Mo is slower. It takes her 10 seconds longer than Bela to open a bottle of wine, and 12 seconds longer than Bela to open a bottle of champagne.

For a Common Room party, Bela opens 50 bottles of wine and 20 bottles of champagne. It takes him 30 minutes and 40 seconds. Mo opens 10 bottles of wine and 30 bottles of champagne. It takes her 27 minutes and 40 seconds.

Use simultaneous equations to work out how long it takes Bela to open a bottle of wine.

4. (a) Andrew halves a certain number and adds 3 to the result. He finds that he obtains the same answer if he multiplies his original number by 4 and then subtracts 9 from the result. What is Andrew's original number?

(b) Ben adds 3 to a certain number and squares the result. He finds that he obtains the same answer if he squares his original number and then adds 20 to the result. What is Ben's original number?

(c) Charles squares a certain number and adds 8 to the result. He finds that he obtains the same answer if he doubles his original number and then adds 43 to the result. Find the possible values of Charles's original number.

[Note: the answers to these questions are not necessarily integers]

5. (a) Calculate $\frac{1}{6}[(5\times4\times3)-(3\times2\times1)]$

(b) Calculate $\frac{1}{6}[(6\times5\times4)-(4\times3\times2)]$

(c) Calculate $\frac{1}{6}[(7\times6\times5)-(5\times4\times3)]$

(d) Calculate $\frac{1}{6}[(102\times101\times100)-(100\times99\times98)]$

(e) Write down a formula that summarizes all of the above calculations.

(f) Justify your formula.

6. You are told that x and y are both odd numbers. Decide which of the following calculations are always odd, which are always even, and which are sometimes odd and sometimes even. Justify your anwers.

(a) $x+y$

(b) $4x+3y$

(c) $\frac{1}{2}(3x+y)$

(d) xy

(e) x^2+y^2

(f) $\frac{1}{2}(x^2-y^2)$