RADLEY

Scholarship Examination

MATHEMATICS II

23 February, 2022

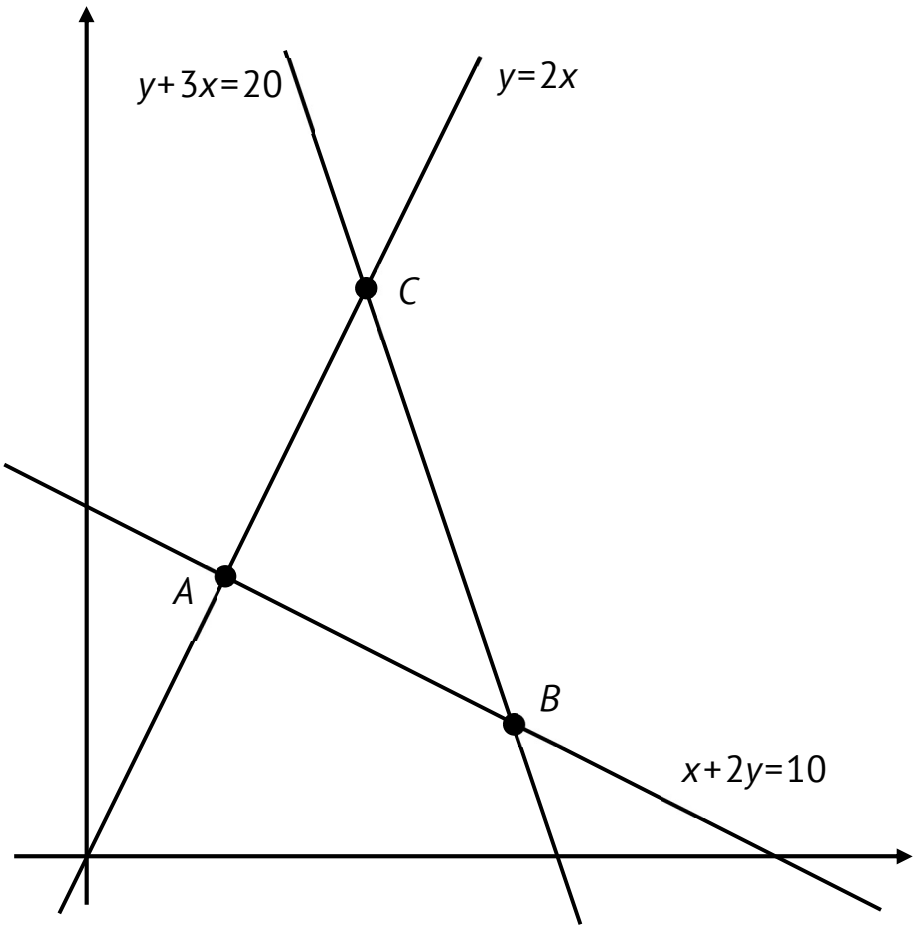
Time allowed – 1 hour

Show all working

Calculators may be used

1. On Tuesday 1 March I run 10km. On Wednesday 2 March I run 20% further than I ran on Tuesday 1 March. On Thursday 3 March I run 10% less than I ran on Wednesday 2 March. I continue this training programme, increasing by 20% on one day, and then decreasing by 10% on the following day. On what date will I first run more than 20km?

2.



The diagram above shows three lines, $y=2x$, $x+2y=10$ and $y+3x=20$, meeting at the points A, B and C.

a. By solving the appropriate simultaneous equations, find the coordinates of the points A, B and C.

b. Calculate the area of the triangle ABC.

3. The formula $n(n+1)/2$ gives the sum of the integers between 1 and n inclusive.

   So $1+2+3+\cdots+n = n(n+1)/2$

   For example, $1+2+3+4+5+6 = 6(6+1)/2=21$

   Using this formula for the sum of the integers between 1 and n inclusive, find each of the following:

   a. $1+2+3+\cdots+100$

   b. $1+2+3+\cdots+200$

   c. $101+102+103+\cdots+200$

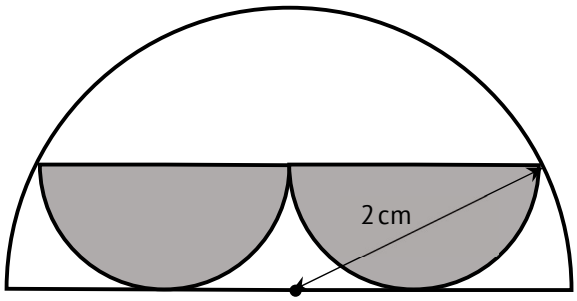
   d. $10+20+30+\cdots+1000$

   e. $11+21+31+\cdots+1001$

   f. $2+4+6+\cdots+200$

   g. $1+3+5+\cdots+199$

4.



   The diagram shows two equal shaded semicircles inside a larger semicircle. The larger semicircle has radius 2 cm. Calculate the area of one of the shaded semicircles, leaving your answer as a multiple of π.

5. a i Solve the equation $x^2-7x+12 = 0$

ii Hence, or otherwise, solve the equation $(3x-2)^2-7(3x-2)+12=0$

b Solve the equation $(x^2-25)(x+7)-8x(x+5)^2+5(x^2+5x)+15(x+5)=0$

6.

Each week the junior civil servant in Downing Street wheels a suitcase to the local supermarket to buy alcohol. He always spends the same amount of money.

In week 1 he buys 10 bottles of gin, 5 bottles of vodka and 9 bottles of wine.

In week 2 he buys 4 bottles of gin, 10 bottles of vodka and 12 bottles of wine.

In week 3 he buys 2 bottles of gin and 27 bottles of wine.

In week 4 the Cabinet Secretary decrees that only vodka can be purchased. How many bottles of vodka can he buy?