1 A shop stocks hats in sizes small, medium and large.

It is decided that the total number of medium and large hats should be at most half of the number of small hats.

The number of large hats should be at most 40% of the total number of hats.

The maximum number of hats that can be stored is 200.

Small, medium and large hats give a profit of £3, £5 and £6 respectively.

Let the number of small, medium and large hats be x, y and z respectively.

The shop wishes to maximise its profit, £C, for the hats.

Formulate this situation as a linear programming problem, simplifying your inequalities so all coefficients are integers. **(5 marks)**

2 A linear programming problem in x and y is described as follows.

Minimise $C = 2x + 3y$

Subject to

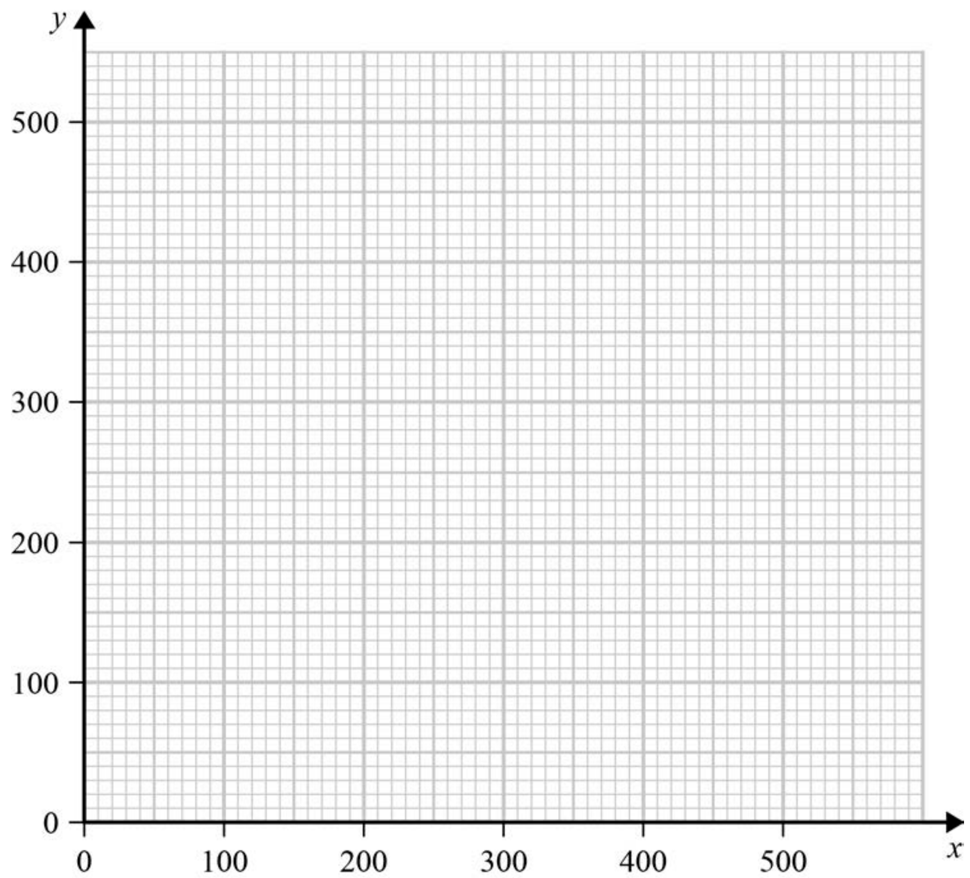
$5x + 4y \geqslant 2000$

$y \leqslant 2x$

$y \geqslant x - 150$

$x, y \geqslant 0$

a Represent these inequalities on the graph below, including shading. **(3 marks)**



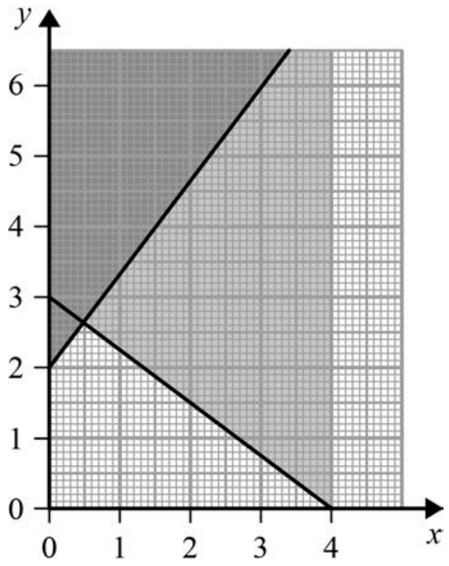
b Show the feasible region, labelling it R. **(1 mark)**

c Use **point testing** to determine the exact coordinates of the optimal point P.
You must show your working. **(5 marks)**

The first constraint is changed to $x + y \geqslant k$ for some value of k.

d Determine the greatest value of k for which P is still optimal. **(2 marks)**

3 The constraints of a linear programming problem are represented by the graph below.



The feasible region is the unshaded region, including its boundaries.

a Write down four inequalities that define the feasible region. **(3 marks)**

The objective is to maximise $P = x + 2y$

b Use the graph and a profit line to obtain the coordinates of the vertices of the feasible region. Hence find the values of x and y that maximise P and the corresponding maximum value of P. **(5 marks)**