**7.** A company makes three types of storage container, small, medium and large.

The company owner knows that each week she should make

- at least 40 containers in total
- at least twice as many large containers as medium containers
- at most 60% small containers

Each small container requires 1 hour to make, each medium container requires 1.5 hours to make, and each large container requires 2.5 hours to make. The company has a total of 75 hours per week available to make all the containers.

Each small container costs £9 to make, each medium container costs £12 to make and each large container costs £16 to make.

The company owner wants to minimise her total cost.

- Let $x$ represent the number of small containers made
- Let $y$ represent the number of medium containers made
- Let $z$ represent the number of large containers made

(a) Formulate this information as a linear programming problem. State the objective and list the constraints as simplified inequalities with integer coefficients.

**(7)**

The company owner now decides to make exactly 45 containers.

(b) Explain why the minimum total cost is achieved when $7x + 4y$ is maximised.

**(3)**

The requirement to make exactly 45 containers reduces the constraints of the problem to the following:

$$x + 3y \leqslant 45$$

$$0 \leqslant x \leqslant 27$$

$$3x + 2y \geqslant 75$$

$$y \geqslant 0$$

(c) Represent these constraints on Diagram 1 in the answer book. Hence determine, and label, the feasible region, $R$.

**(4)**

(d) Use the objective line method to find the optimal vertex, $V$, of the feasible region. You must make your objective line clear and label $V$.

**(2)**

(e) Write down the number of each type of container the company should make. Calculate the corresponding total cost.

**(2)**

**(Total 18 marks)**

**TOTAL FOR PAPER = 75 MARKS**

**END**

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**7.**

**Question 7 continued**

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**Question 7 continued**

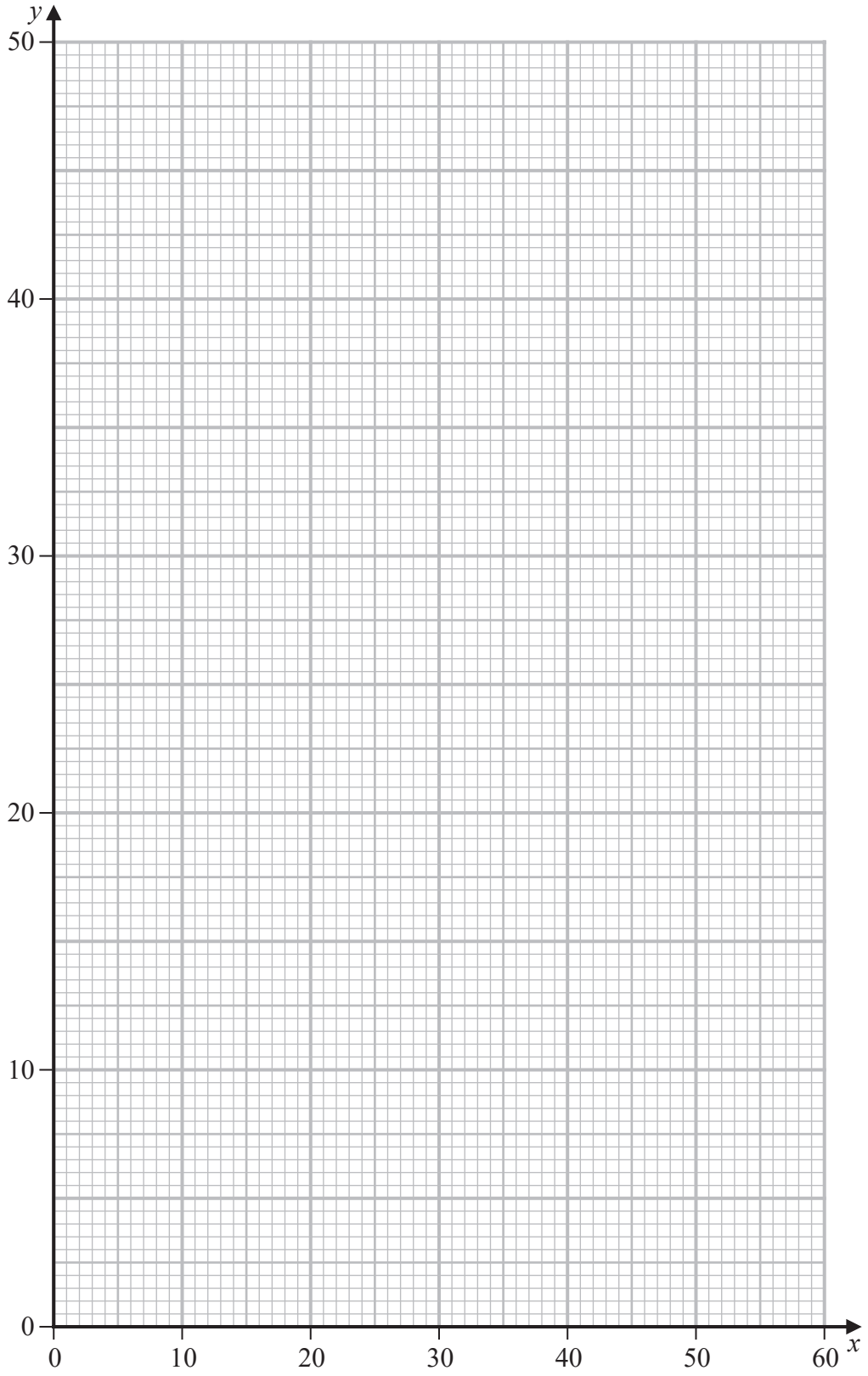



**Diagram 1**

**Question 7 continued**

**(Total 18 marks)**

**TOTAL FOR PAPER = 75 MARKS**

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