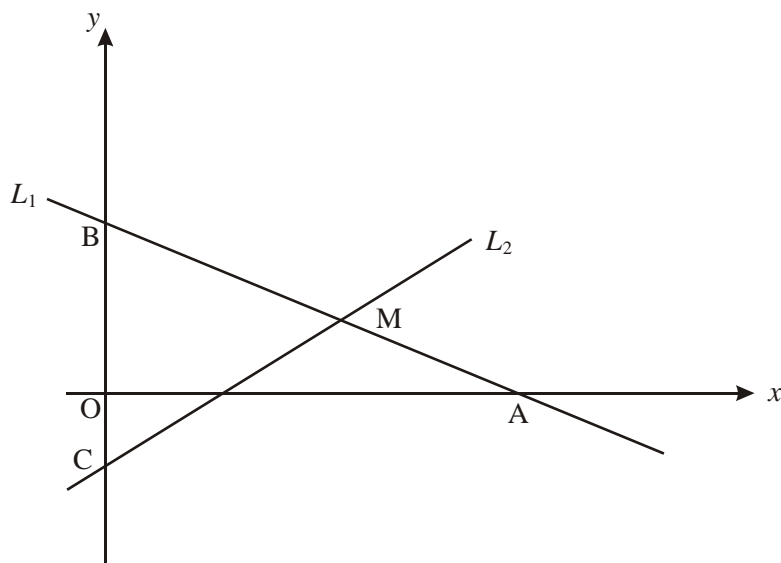**1.** The line L_1 shown on the set of axes below has equation $3x + 4y = 24$. L_1 cuts the x-axis at A and cuts the y-axis at B.

Diagram not drawn to scale

(a)   Write down the coordinates of A and B.

(2)

M is the midpoint of the line segment [AB].

(b)   Write down the coordinates of M.

(2)

The line L_2 passes through the point M and the point C $(0, –2)$.

(c)   Write down the equation of L_2.

(2)

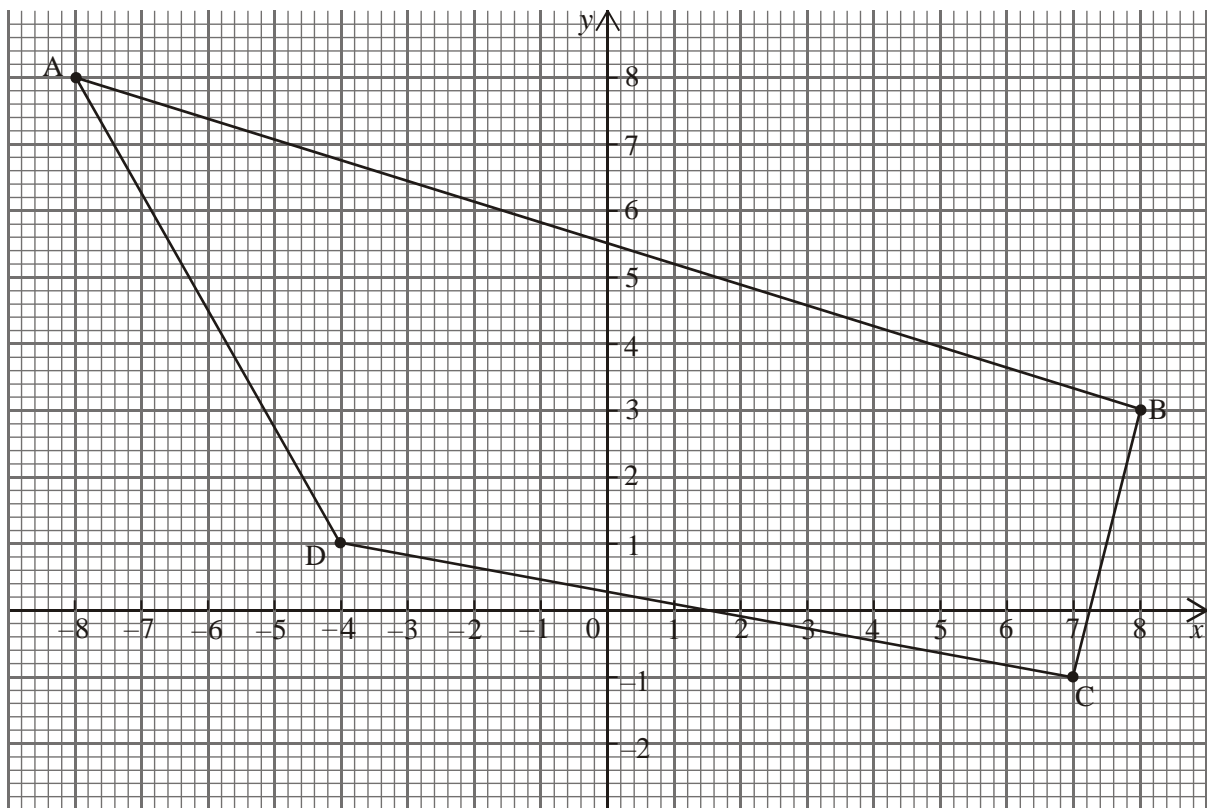(d)   Find the length of

　　(i)   MC;

(2)

　　(ii)   AC.

(2)

(e)   The length of AM is 5. Find

　　(i)   the size of angle CMA;

(3)

　　(ii)   the area of the triangle with vertices C, M and A.

(2)
(Total 15 marks)

2. The vertices of quadrilateral ABCD as shown in the diagram are A (–8, 8), B (8, 3), C (7,–1) and D (–4, 1).

The gradient of the line AB is $-\dfrac{5}{16}$.

(a) Calculate the gradient of the line DC.

(2)

(b) State whether or not DC is parallel to AB and give a reason for your answer.

(2)

The equation of the line through A and C is $3x + 5y = 16$.

(c) Find the equation of the line through B and D expressing your answer in the form $ax + by = c$, where a, b and $c \in \mathbb{Z}$.

(5)

The lines AC and BD intersect at point T.

(d) Calculate the coordinates of T.

(4)
(Total 13 marks)

3. On the coordinate axes below, D is a point on the *y*-axis and E is a point on the *x*-axis.

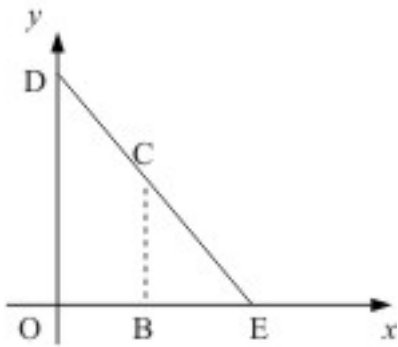O is the origin. The equation of the line DE is $y + \dfrac{1}{2} x = 4$.

diagram not to scale

(a) Write down the coordinates of point E.

(2)

C is a point on the line DE. B is a point on the *x*-axis such that BC is parallel to the *y*-axis. The *x*-coordinate of C is *t*.

(b) Show that the *y*-coordinate of C is $4 - \dfrac{1}{2}t$.

(2)

OBCD is a trapezium. The *y*-coordinate of point D is 4.

(c) Show that the area of OBCD is $4t - \dfrac{1}{4}t^2$.

(3)

(d) The area of OBCD is 9.75 square units. Write down a quadratic equation that expresses this information.

(1)

(e) (i) Using your graphic display calculator, or otherwise, find the two solutions to the quadratic equation written in part (d).

(ii) Hence find the correct value for *t*. Give a reason for your answer.

(4)
(Total 12 marks)

4. The vertices of quadrilateral ABCD as shown in the diagram are A (3, 1), B (0, 2), C (–2, 1) and D (–1, –1).
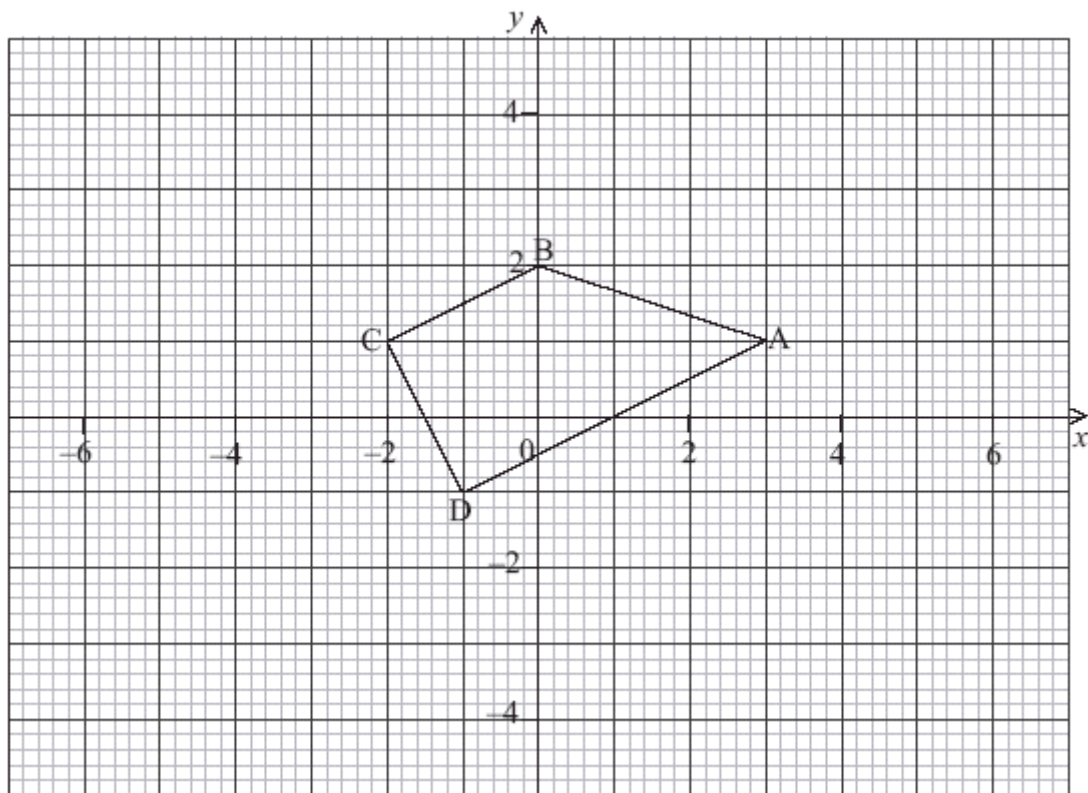
(a) Calculate the gradient of line CD.

(2)

(b) Show that line AD is perpendicular to line CD.

(2)

(c) Find the equation of line CD. Give your answer in the form $ax + by = c$
where $a, b, c \in \mathbb{Z}$.

(3)

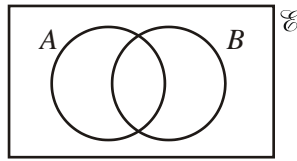Lines AB and CD intersect at point E. The equation of line AB is $x + 3y = 6$.

(d) Find the coordinates of E.

(2)

(e) Find the distance between A and D.
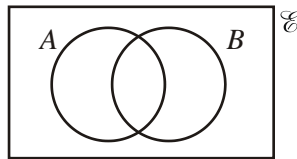
(2)

The distance between D and E is $\sqrt{20}$.

(f) Find the area of triangle ADE.

(2)
(Total 13 marks)

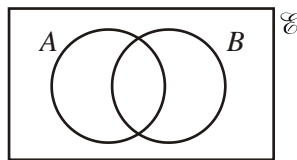**5.** In each of the Venn diagrams, shade the region indicated.
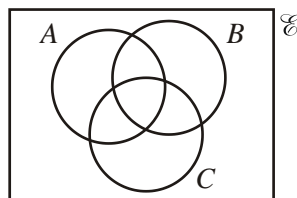
(a) $A \cap B$

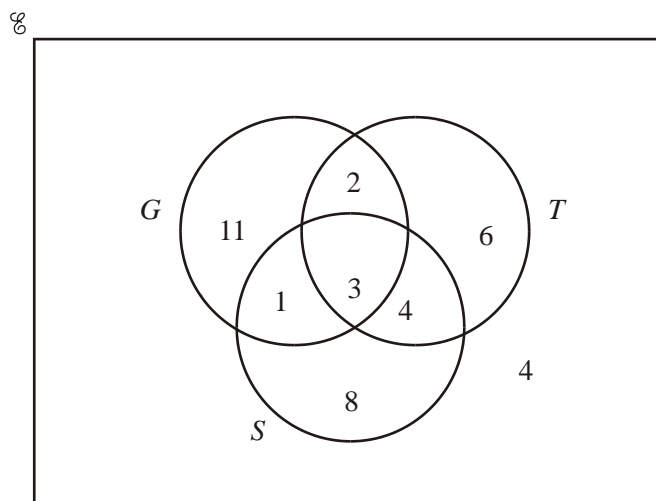(b) The complement of $(A \cap B)$

(c) The complement of $(A \cup B)$

(d) $A \cup (B \cap C)$

(Total 4 marks)

6. The sports offered at a retirement village are Golf (G), Tennis (T) and Swimming (S). The Venn diagram shows the numbers of people involved in each activity.

(a) How many people

    (i) only play golf?

    (ii) play both tennis and golf?

    (iii) do not play golf?

(b) Shade the part of the Venn diagram that represents the set $G \cap S$.

(Total 4 marks)

7. The sets U, P, R and S are defined as follows:

U = {all quadrilaterals}
P = {all parallelograms}
R = {all rectangles}
S = {all squares}

(a) Draw a Venn Diagram illustrating the relationships of the above sets.

(4)

(b) Draw a separate Venn Diagram for each of the examples below.
Indicate by shading each of the following:

    (i) $(P \cup S)'$

    (ii) $(R \cup S) \cap P$

(4)
(Total 8 marks)

8. A survey was carried out in a year 12 class. The pupils were asked which pop groups they like out of the *Rockers* (*R*), the *Salseros* (*S*), and the *Bluers* (*B*).
The results are shown in the following diagram.
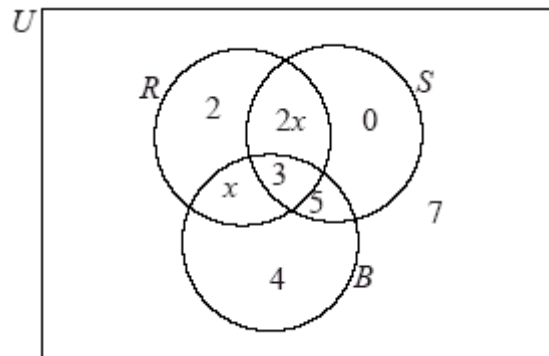
(a) Write down $n(R \cap S \cap B)$.

(1)

(b) Find $n(R')$.

(2)

(c) Describe which groups the pupils in the set $S \cap B$ like.

(2)

(d) Use set notation to describe the group of pupils who like the *Rockers* and the *Bluers* but do not like the *Salseros*.

(2)

There are 33 pupils in the class.

(e) (i) Find x.

(ii) Find the number of pupils who like the *Rockers*.

(3)
(Total 10 marks)

9. In the Venn diagram below, *A*, *B* and *C* are subsets of a universal set $U = \{1,2,3,4,6,7,8,9\}$.
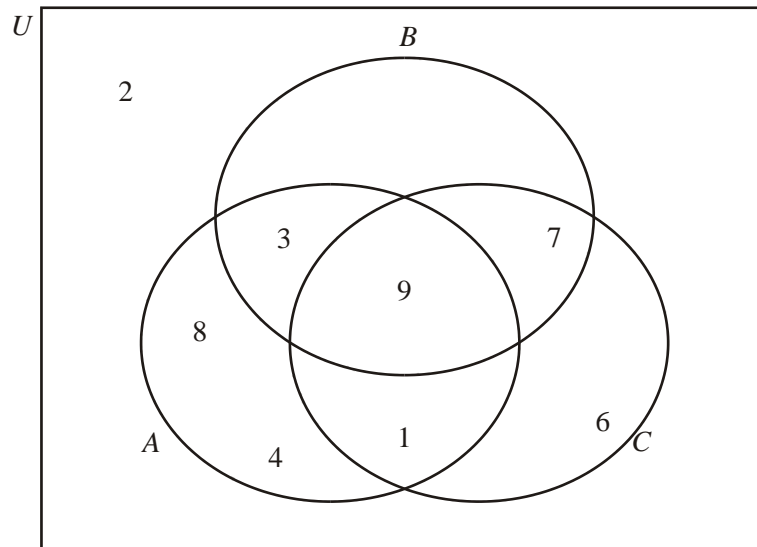
List the elements in each of the following sets.

(a) $A \cup B$

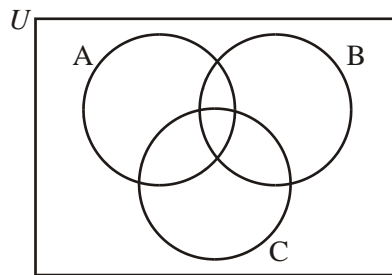(b) $A \cap B \cap C$

(c) $(A' \cap C) \cup B$

(Total 8 marks)

10. Given $\mathbb{Z}$ the set of integers, $\mathbb{Q}$ the set of rational numbers, $\mathbb{R}$ the set of real numbers.

(a) Write down an element that belongs to $\mathbb{R} \cap \mathbb{Z}$.

(b) Write down an element that belongs to $\mathbb{Q} \cap \mathbb{Z}'$.

(c) Write down an element that belongs to $\mathbb{Q}'$.

(d) Use a Venn diagram to represent the sets $\mathbb{Z}$, $\mathbb{Q}$ and $\mathbb{R}$.
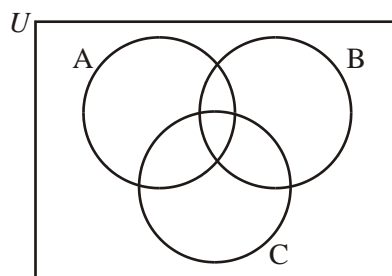
(Total 6 marks)

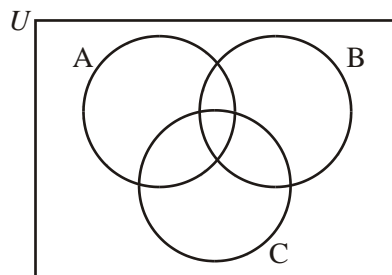**10.** Shade the given region on the corresponding Venn Diagram.
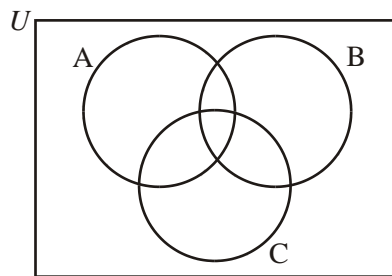
(a) $A \cap B$

(b) $C \cup B$

(c) $(A \cup B \cup C)'$

(d) $A \cap C'$

(Total 8 marks)

12. Given a universal set $U = \{\text{cars}\}$, $S = \{\text{sports cars}\}$, $G = \{\text{green sports cars}\}$.

    (a)   Draw a Venn diagram to illustrate this information.

                        (3)

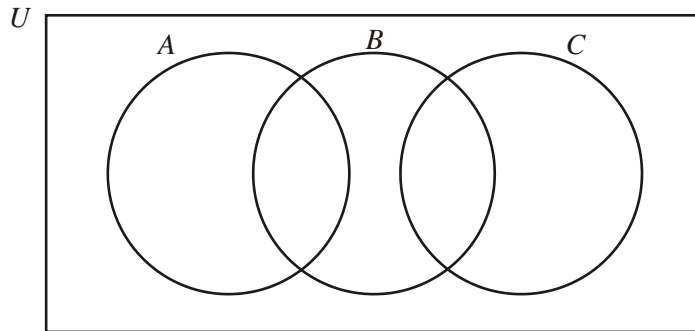   (b)   Shade the set $S \cap G'$ on your diagram.

                        (1)
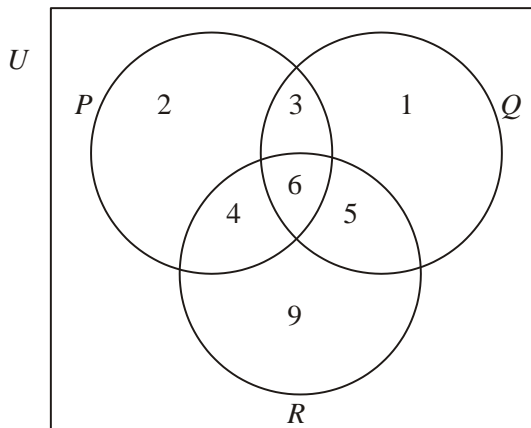
    (c)   Write in words the meaning of $S \cap G'$.

                        (2)
                 (Total 6 marks)

13.   (a)   Shade $(A \cup B) \cap C'$ on the diagram below.

                        (2)

    (b)   In the Venn diagram below, the number of elements in each region is given. Find $n\,((P \cap Q) \cup R)$.

                        (2)

    (c) U is the set of positive integers, $\mathbb{Z}^+$.
            E is the set of even numbers.
            M is the set of multiples of 3.

        (i)   List the first six elements of the set M.

        (ii)   List the first six elements of the set $E' \cap M$.

                        (2)
                 (Total 6 marks)