1   Find and simplify the first three terms in the expansion of $(2 - 3x)^6$ in ascending powers of x.   [4]
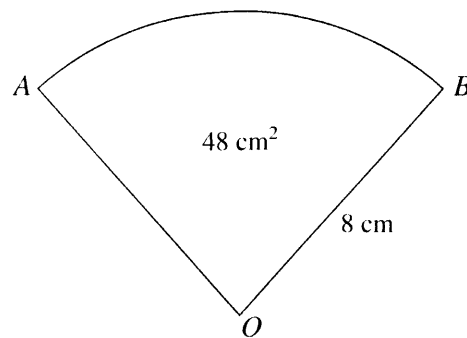
2   A sequence u_1, u_2, u_3, ... is defined by

$$u_1 = 3 \quad \text{and} \quad u_{n+1} = 1 - \frac{1}{u_n} \text{ for } n \geqslant 1.$$

   (i) Write down the values of u_2, u_3 and u_4.   [3]

   (ii) Describe the behaviour of the sequence.   [1]

3

   The diagram shows a sector AOB of a circle with centre O and radius 8 cm. The area of the sector is 48 cm^2.

   (i) Find angle AOB, giving your answer in radians.   [2]
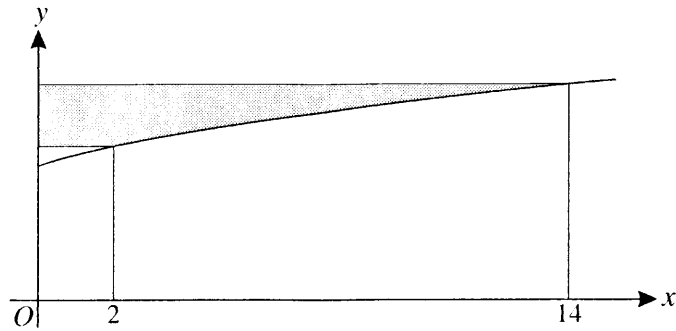
   (ii) Find the area of the segment bounded by the arc AB and the chord AB.   [3]

4   The cubic polynomial $ax^3 - 4x^2 - 7ax + 12$ is denoted by $f(x)$.

   (i) Given that $(x - 3)$ is a factor of $f(x)$, find the value of the constant a.   [3]

   (ii) Using this value of a, find the remainder when $f(x)$ is divided by $(x + 2)$.   [2]

5

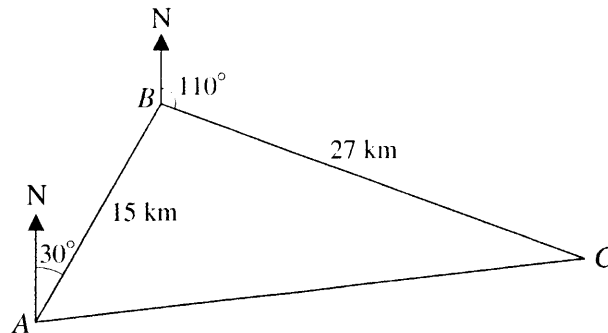The diagram shows the curve $y = 3 + \sqrt{x+2}$.

The shaded region is bounded by the curve, the y-axis, and two lines parallel to the x-axis which meet the curve where $x = 2$ and $x = 14$.

    (i) Show that the area of the shaded region is given by

$$\int_5^7 (y^2 - 6y + 7)\, dy.$$

                                                                                                                [3]

    (ii) Hence find the exact area of the shaded region.   **[4]**

6

In the diagram, a lifeboat station is at point A. A distress call is received and the lifeboat travels 15 km on a bearing of $030°$ to point B. A second call is received and the lifeboat then travels 27 km on a bearing of $110°$ to arrive at point C. The lifeboat then travels back to the station at A.

    (i) Show that angle ABC is $100°$.   **[1]**

    (ii) Find the distance that the lifeboat has to travel to get from C back to A.   **[2]**

    (iii) Find the bearing on which the lifeboat has to travel to get from C to A.   **[4]**

7   **(a)** Find $\displaystyle\int x^3(x^2 - x + 5)\, dx$.   **[4]**

    (b)   **(i)** Find $\displaystyle\int 18x^{-4}\, dx$.   **[2]**

         (ii) Hence evaluate $\displaystyle\int_2^\infty 18x^{-4}\, dx$.   **[2]**