

9.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

FINEVIEW

(a) At D,
 $y = 0 = |7 - 3x|$
 $7 - 3x = 0$
 $x = \frac{7}{3}$ (1 mark)

(b) $x = 2$
 $\Rightarrow |7 - 3x| = |7 - 3(2)|$
 $= |1| = 1$

$x = 2$
 $\Rightarrow -2x^2 + 14x - 19$
 $= -2(2)^2 + 14(2) - 19$
 $= -8 + 28 - 19 = 1$

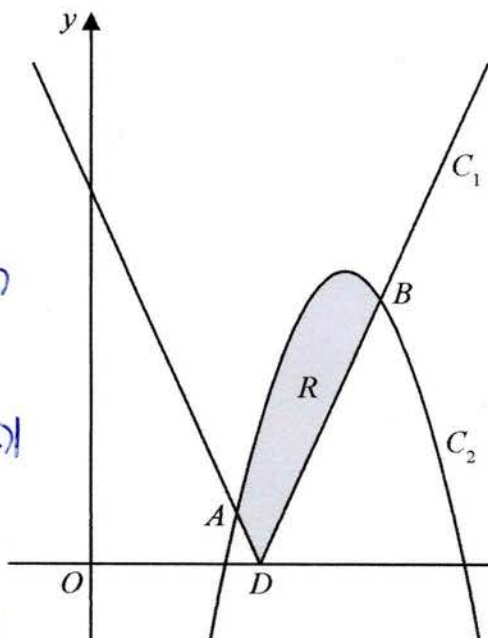


Figure 2

So C_1 & C_2
 meet at $A(2, 1)$
 (1 mark)

In Figure 2

- the graph C_1 has equation $y = |7 - 3x|$
- the curve C_2 has equation $y = -2x^2 + 14x - 19$
- C_1 intersects C_2 at the points A and B

Given that C_1 meets the x-axis at the point D, as shown in Figure 2,

- (a) find the x coordinate of D. (d) Area $R = \text{Area under Curve} - \text{Area under Triangles}$ (1)
- (b) Verify that the x coordinate of A is 2 (1)
- (c) Using algebra and showing your working, find the coordinates of B. (3)

The region R, shown shaded in Figure 2, is bounded by C_1 and C_2

(d) Use algebraic integration to find the area of R.

(d) contd Area under Curve = $\int_2^4 -2x^2 + 14x - 19 = \left[-\frac{2}{3}x^3 + 7x^2 - 19x \right]_2^4$ (2 marks) (5)

$= \left(-\frac{2}{3}(4)^3 + 7(4)^2 - 19(4) \right) - \left(-\frac{2}{3}(2)^3 + 7(2)^2 - 19(2) \right) = -\frac{20}{3} + \frac{46}{3} = \frac{26}{3}$ (1 mark)

Area under Triangles = $\left(\frac{1}{2} \times b \times h \right) + \left(\frac{1}{2} \times b \times h \right) = \frac{1}{2} \left(\frac{7}{3} - 2 \right) (1) + \frac{1}{2} \left(4 - \frac{7}{3} \right) (5) = \frac{13}{3}$ (1 mark)

Area $R = \frac{26}{3} - \frac{13}{3} = \frac{13}{3}$ (1 mark)

(c) $y = 7 - 3x$ has negative gradient (-3), so A is intercept with $y = 7 - 3x$, and B is intercept with $y = -7 + 3x$

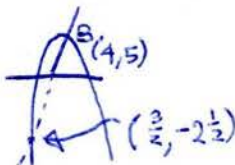
$-7 + 3x = -2x^2 + 14x - 19$
 $\Rightarrow 2x^2 - 11x + 12 = 0$

$2x^2 - 3x - 8x + 12 = 0$
 $x(2x - 3) - 4(2x - 3) = 0$
 $(x - 4)(2x - 3) = 0$
 $x = 4, \frac{3}{2}$ (1 mark)

(c) contd

$y = -2(4)^2 + 14(4) - 19 = 5$

$y = -2\left(\frac{3}{2}\right)^2 + 14\left(\frac{3}{2}\right) - 19 = -2\frac{1}{2}$



so B is (4, 5) (2 marks)