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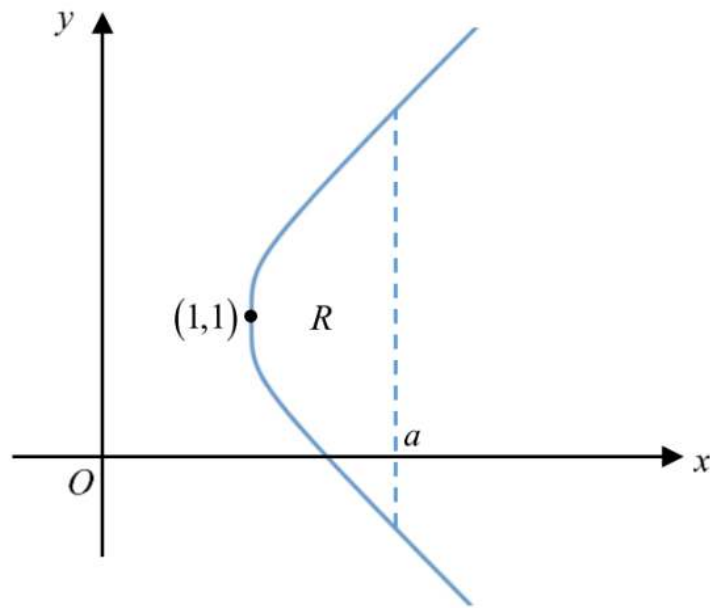


VIDEO SOLUTIONS FOR THIS WORKSHEET

APPLICATIONS OF INTEGRATION

2013 RVHS PROMO Q3

The diagram shows the sketch of the curve C , $(y-1)^2 = x\sqrt{x^2-1}$, with the vertex at $(1,1)$.

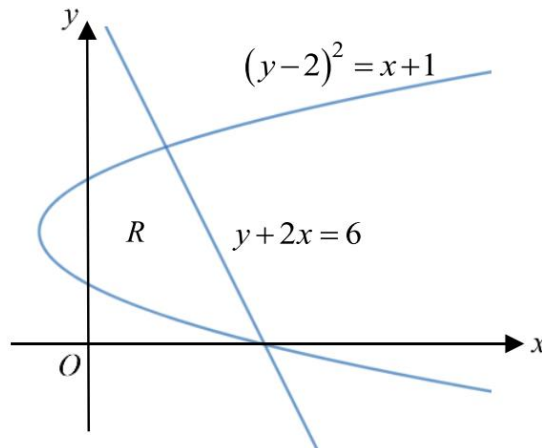


- (i) Write down the equation of the graph when C is translated 1 unit in the negative y -direction. [1]
- (ii) The shaded region R , bounded by C and the vertical line, $x = a$, is rotated through π radians about the line $y = 1$. By using the substitution $u = \sqrt{x^2 - 1}$, or otherwise, find the exact volume obtained in terms of a . [5]

Answers: (i) $y^2 = x\sqrt{x^2 - 1}$ (ii) $\frac{\pi}{3}(a^2 - 1)^{\frac{3}{2}}$

2013 AJC PROMO Q8

The diagram shows a shaded region R bounded by the curve $(y-2)^2 = x+1$ and the line $y+2x=6$.

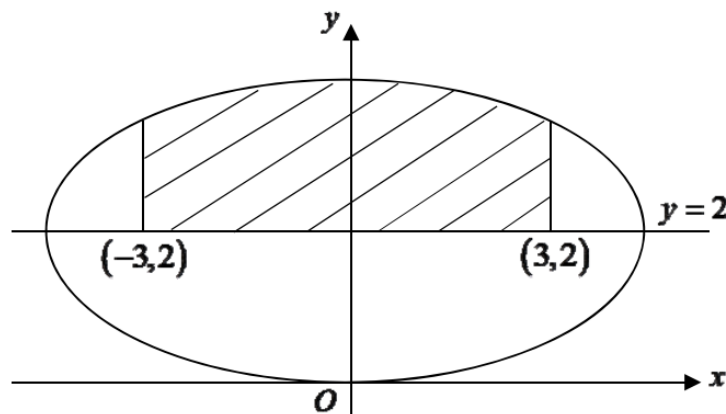


Find the volume generated when R is rotated through 2π radians about the x -axis, leaving your answer correct to 3 significant figures.

Answer: 78.6 units³

2017 YJC P1 Q9

- (a) By using the substitution $x = 3\sec\theta$, evaluate $\int_{3\sqrt{2}}^6 \frac{3x+1}{\sqrt{x^2-9}} dx$ exactly. [5]
- (b)



The diagram shows an ellipse with equation $\frac{x^2}{16} + \frac{(y-2)^2}{4} = 1$.

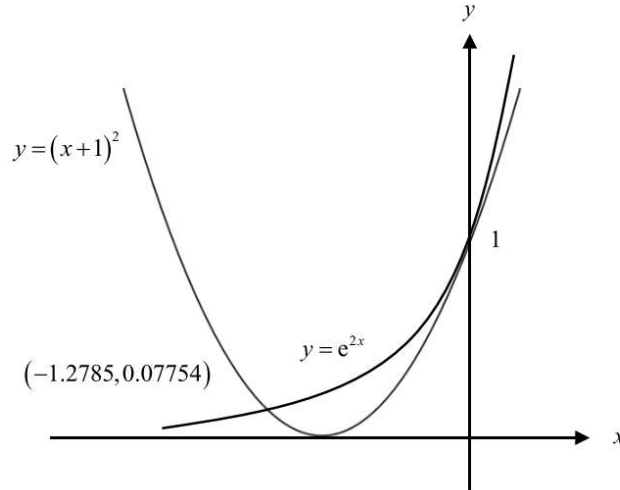
- (i) Find the area of the shaded region, giving your answer correct to 3 decimal places. [2]
- (ii) Find the exact volume of the solid generated when the shaded region is rotated 180° about the y -axis. [4]

Answers: (a) $9\sqrt{3} - 9 + \ln \frac{2+\sqrt{3}}{\sqrt{2}+1}$ (b)(i) 10.753 (3 dp) (ii) $\frac{1}{3}(64 - 7\sqrt{7})\pi$

2020 ASRJC P2 Q4

(a) Find $\int \left(\cot^6 2x + \cot^4 2x - \sin \frac{x}{2} \sin \frac{3x}{2} \right) dx$. [3]

(b) The diagram shows the graphs of $y = e^{2x}$ and $y = (x+1)^2$.



R is the finite region bounded by the two curves $y = e^{2x}$ and $y = (x+1)^2$.

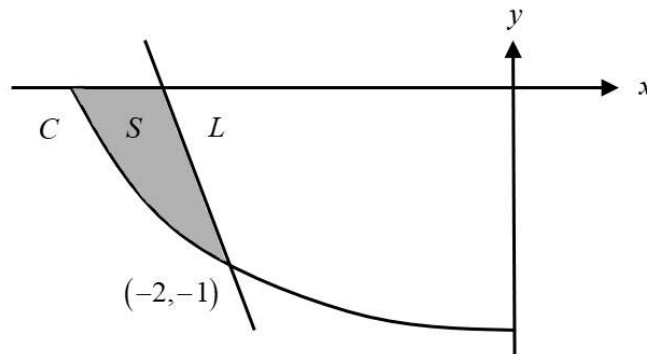
Find the volume of the solid formed when R is rotated through 2π radians about the y -axis, giving your answer correct to 4 decimal places. [3]

(c) A curve C has parametric equations

$$x = 2 \left(\sin \frac{t}{2} - \cos \frac{t}{2} \right), \quad y = \sin \frac{t}{2} + \cos \frac{t}{2}, \quad \text{for } -\frac{3\pi}{2} \leq t \leq -\frac{\pi}{2}.$$

The line L with equation $y = -2x - 5$ meets the curve C at the point $(-2, -1)$.

S is the region enclosed by line L , curve C and the x -axis as shown in the diagram below.



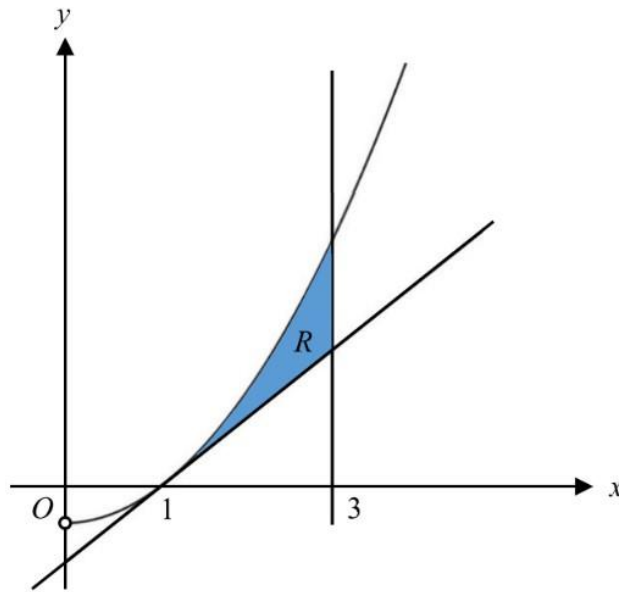
(i) Show that the x -intercept of curve C is $-2\sqrt{2}$. [2]

(ii) Find the exact area of S . [6]

Answers: (a) $-\frac{1}{5} \cot^5 2x + \frac{1}{4} \sin 2x - \frac{1}{2} \sin x + c$ (b) 0.5593 units^3 (4 d.p.) (c) (ii) $\frac{\pi}{2} - \frac{5}{4} \text{ units}^2$

2011 CJC P1 Q8

The diagram below shows the curve with equation $y = x^2 - 1$, $x > 0$ and the tangent $y = 2x - 2$ to the curve at the point $(1, 0)$.



- (i) Write down the coordinates of the point where this tangent meets the line $x = 3$. [1]

The region, R , shaded in the diagram, is bounded by the curve, the tangent to the curve at $(1, 0)$ and the line $x = 3$.

Find

- (ii) the area of R , [2]
- (iii) the exact volume of the solid of revolution obtained when R is rotated through 2π radians about the y -axis. [4]