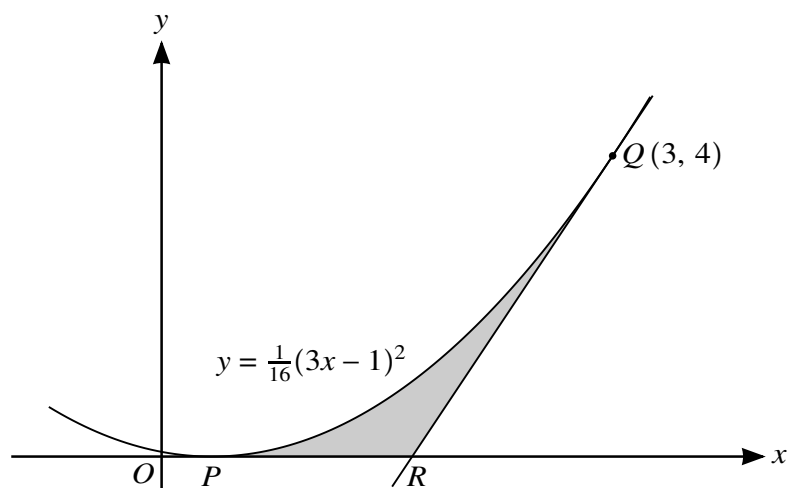


9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

1. Question | 9709 Feb-March 2016 P1 V2 Q2

- 2** A curve for which $\frac{dy}{dx} = 3x^2 - \frac{2}{x^3}$ passes through $(-1, 3)$. Find the equation of the curve. [4]

10

The diagram shows part of the curve $y = \frac{1}{16}(3x - 1)^2$, which touches the x -axis at the point P . The point $Q(3, 4)$ lies on the curve and the tangent to the curve at Q crosses the x -axis at R .

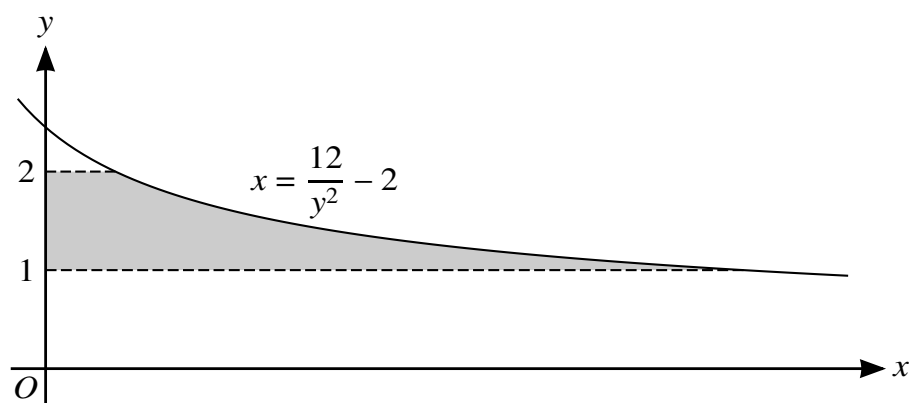
- (i) State the x -coordinate of P . [1]

Showing all necessary working, find by calculation

- (ii) the x -coordinate of R , [5]
 (iii) the area of the shaded region PQR . [6]

3. Question | 9709 May-June 2016 P1 V1 Q3

3



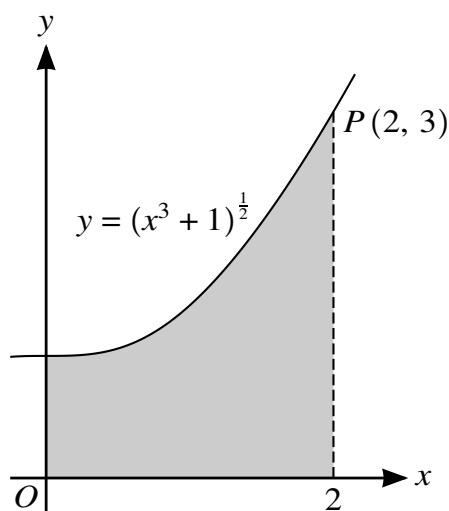
The diagram shows part of the curve $x = \frac{12}{y^2} - 2$. The shaded region is bounded by the curve, the y -axis and the lines $y = 1$ and $y = 2$. Showing all necessary working, find the volume, in terms of π , when this shaded region is rotated through 360° about the y -axis. [5]

4. Question | 9709 May-June 2016 P1 V2 Q2

2 A curve is such that $\frac{dy}{dx} = \frac{8}{(5-2x)^2}$. Given that the curve passes through $(2, 7)$, find the equation of the curve. [4]

5. Question | 9709 May-June 2016 P1 V3 Q2

2



The diagram shows part of the curve $y = (x^3 + 1)^{\frac{1}{2}}$ and the point $P(2, 3)$ lying on the curve. Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the x -axis. [4]

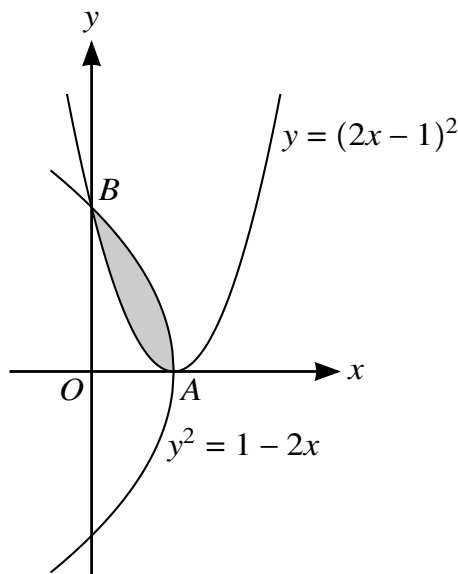
6. Question | 9709 May-June 2016 P1 V3 Q3

- 3** A curve is such that $\frac{dy}{dx} = 6x^2 + \frac{k}{x^3}$ and passes through the point $P(1, 9)$. The gradient of the curve at P is 2.

(i) Find the value of the constant k . [1]

(ii) Find the equation of the curve. [4]

7. Question | 9709 Oct-Nov 2016 P1 V1 Q7

7

The diagram shows parts of the curves $y = (2x - 1)^2$ and $y^2 = 1 - 2x$, intersecting at points A and B .

(i) State the coordinates of A . [1]

(ii) Find, showing all necessary working, the area of the shaded region. [6]

8. Question | 9709 Oct-Nov 2016 P1 V1 Q10

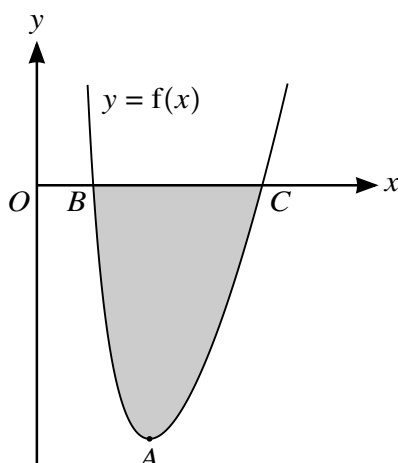
- 10** A curve has equation $y = f(x)$ and it is given that $f'(x) = 3x^{\frac{1}{2}} - 2x^{-\frac{1}{2}}$. The point A is the only point on the curve at which the gradient is -1 .

(i) Find the x -coordinate of A . [3]

(ii) Given that the curve also passes through the point $(4, 10)$, find the y -coordinate of A , giving your answer as a fraction. [6]

9. Question | 9709 Oct-Nov 2016 P1 V2 Q1

- 1** A curve is such that $\frac{dy}{dx} = \frac{8}{\sqrt{4x+1}}$. The point $(2, 5)$ lies on the curve. Find the equation of the curve. [4]



(i) Find the x -coordinate of A. [2]

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(iii) Find the x -coordinates of B and C . [4]

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(iv) Find, showing all necessary working, the area of the shaded region. [4]

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9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

11. Question part 1/2 | 9709 May-June 2017 P1 V1 Q7

7 A curve for which $\frac{dy}{dx} = 7 - x^2 - 6x$ passes through the point $(3, -10)$.

(i) Find the equation of the curve.

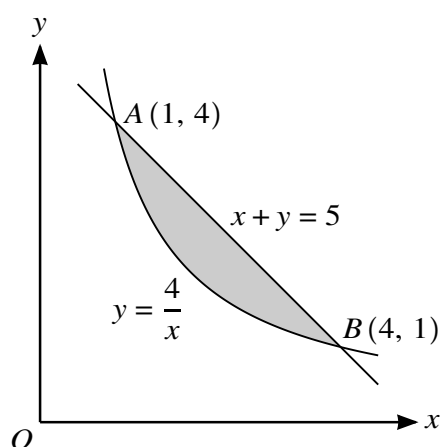
[3]

[illegible]

Topical questions | 91 questions

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- [illegible]



The diagram shows the straight line $x + y = 5$ intersecting the curve $y = \frac{4}{x}$ at the points $A(1, 4)$ and $B(4, 1)$. Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the x -axis. [7]

[illegible]

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Topical questions | 91 questions

12. Question part 2/2 | 9709 May-June 2017 P1 V2 Q6

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10 (a)

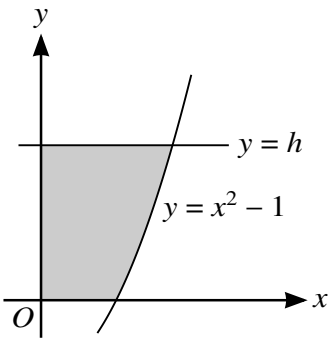


Fig. 1

Fig. 1 shows part of the curve $y = x^2 - 1$ and the line $y = h$, where h is a constant.

- (i) The shaded region is rotated through 360° about the **y-axis**. Show that the volume of revolution, V , is given by $V = \pi(\frac{1}{2}h^2 + h)$. [3]

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- (ii) Find, showing all necessary working, the area of the shaded region when $h = 3$. [4]

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This image shows a full page of white paper with ten horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and extend across the entire width of the page. There is no text or other markings on the paper.

A diagram showing a parabolic cross-section of a container. The interior of the parabola is shaded gray, representing the liquid. A horizontal line indicates the liquid surface. To the right of the parabola, a vertical double-headed arrow labeled h indicates the height of the liquid from the vertex of the parabola to the surface.

Fig. 2

Fig. 2 shows a cross-section of a bowl containing water. When the height of the water level is h cm, the volume, V cm³, of water is given by $V = \pi(\frac{1}{2}h^2 + h)$. Water is poured into the bowl at a constant rate of 2 cm³ s⁻¹. Find the rate, in cm s⁻¹, at which the height of the water level is increasing when the height of the water level is 3 cm. [4]

[illegible]

Topical questions | 91 questions

11 The function f is defined for $x \geq 0$. It is given that f has a minimum value when $x = 2$ and that $f''(x) = (4x + 1)^{-\frac{1}{2}}$.

[illegible]

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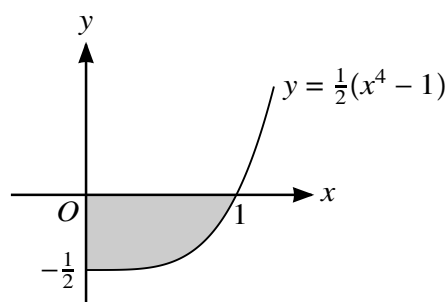
Topical questions | 91 questions

14. Question part 2/2 | 9709 May-June 2017 P1 V3 Q11

(iii) Find $f(x)$, and hence find the minimum value of f .

[5]

[illegible]



(i) Find, showing all necessary working, the area of the shaded region. [3]

[illegible]

This image shows a full page of white paper with ten horizontal dashed lines, typical of primary school handwriting practice paper. The lines are evenly spaced and extend across the entire width of the page. There is no text or other markings on the paper.

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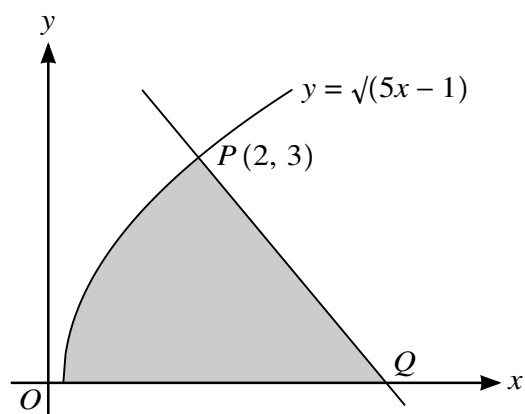
Topical questions | 91 questions

15. Question part 2/2 | 9709 Oct-Nov 2017 P1 V1 Q10

[illegible]

- (iii) Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the y -axis. [5]

[illegible]



(i) Find the equation of the normal at P .

[4]

[illegible]

9709 Mathematics Paper 1 - Integration

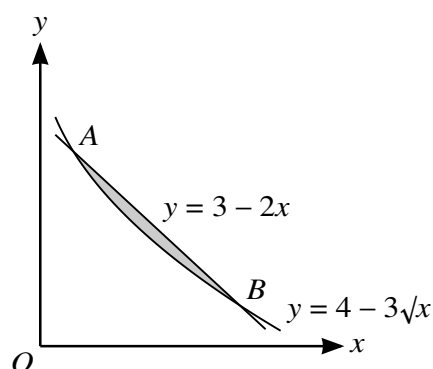
Topical questions | 91 questions

16. Question part 2/2 | 9709 Oct-Nov 2017 P1 V2 Q10

(ii) Find, showing all necessary working, the area of the shaded region.

[7]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



(i) Find by calculation the x -coordinates of A and B . [3]

[illegible]

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Topical questions | 91 questions

17. Question part 2/2 | 9709 Oct-Nov 2017 P1 V3 Q8

(ii) Find, showing all necessary working, the area of the shaded region.

[5]

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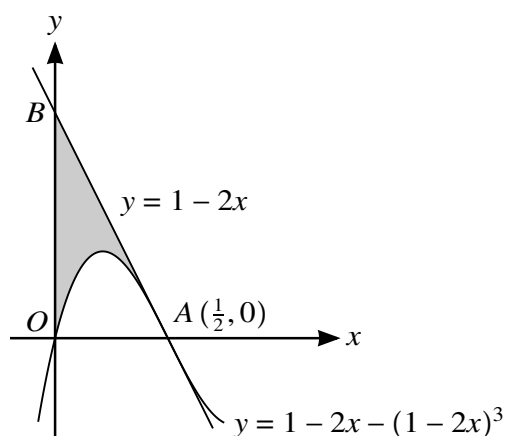
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Topical questions | 91 questions

18. Question | 9709 Feb-March 2018 P1 V2 Q1

- 1** A curve passes through the point $(4, -6)$ and has an equation for which $\frac{dy}{dx} = x^{-\frac{1}{2}} - 3$. Find the equation of the curve. [4]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, leaving ample room for writing practice. There is no text or other markings on the page.



(i) Show that AB is the tangent to the curve at A .

[4]

[illegible]

Topical questions | 91 questions

(ii) Show that the area of the shaded region can be expressed as $\int_0^{\frac{1}{2}} (1 - 2x)^3 \, dx$. [2]

[illegible][illegible]



Additional Page

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20. Question | 9709 May-June 2018 P1 V1 Q3

- 3** A curve is such that $\frac{dy}{dx} = \frac{12}{(2x+1)^2}$. The point (1, 1) lies on the curve. Find the coordinates of the point at which the curve intersects the x-axis. [6]

[illegible]

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21. Question part 1/2 | 9709 May-June 2018 P1 V2 Q9

- 9** A curve is such that $\frac{dy}{dx} = \sqrt{4x + 1}$ and $(2, 5)$ is a point on the curve.

(i) Find the equation of the curve.

[4]

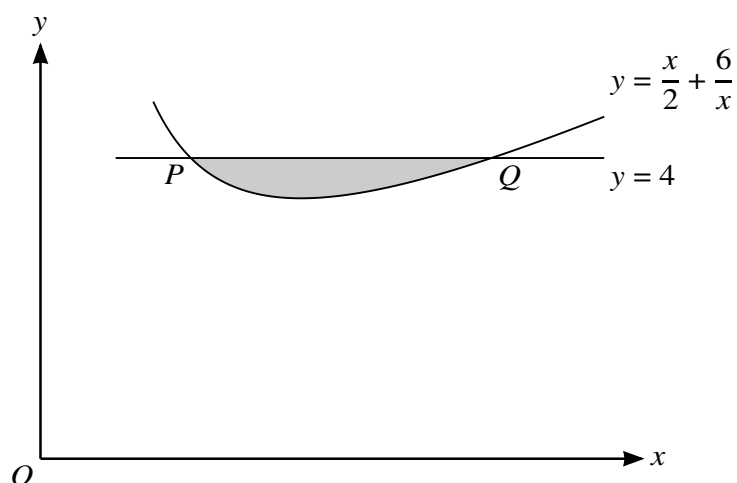
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Topical questions | 91 questions

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(i) Show that the tangents to the curve at P and Q meet at a point on the line $y = x$. [6]

[illegible]

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22. Question part 2/3 | 9709 May-June 2018 P1 V2 Q11

- (ii) Find, showing all necessary working, the volume obtained when the shaded region is rotated through 360° about the x -axis. Give your answer in terms of π . [6]

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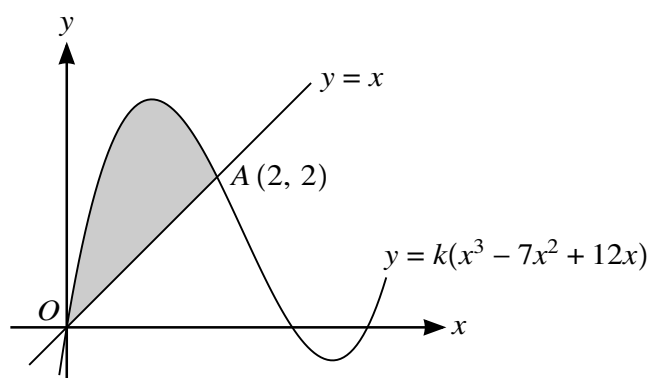
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Topical questions | 91 questions

23. Question | 9709 May-June 2018 P1 V3 Q4

- 4** A curve with equation $y = f(x)$ passes through the point $A(3, 1)$ and crosses the y -axis at B . It is given that $f'(x) = (3x - 1)^{-\frac{1}{3}}$. Find the y -coordinate of B . [6]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



The diagram shows part of the curve with equation $y = k(x^3 - 7x^2 + 12x)$ for some constant k . The curve intersects the line $y = x$ at the origin O and at the point $A(2, 2)$.

- (i) Find the value of k . [1]

- (ii) Verify that the curve meets the line $y = x$ again when $x = 5$. [2]

[illegible]

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Topical questions | 91 questions

24. Question part 2/2 | 9709 Oct-Nov 2018 P1 V1 Q7

(iii) Find, showing all necessary working, the area of the shaded region.

[5]

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Topical questions | 91 questions

25. Question | 9709 Oct-Nov 2018 P1 V2 Q2

2 Showing all necessary working, find $\int_1^4 \left(\sqrt{x} + \frac{2}{\sqrt{x}} \right) dx$. [4]

[illegible]

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26. Question part 1/2 | 9709 Oct-Nov 2018 P1 V3 Q8

- 8** A curve passes through $(0, 11)$ and has an equation for which $\frac{dy}{dx} = ax^2 + bx - 4$, where a and b are constants.

(i) Find the equation of the curve in terms of a and b . [3]

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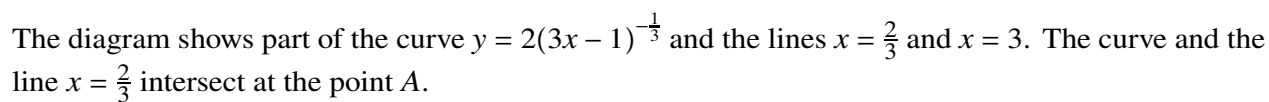
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26. Question part 2/2 | 9709 Oct-Nov 2018 P1 V3 Q8

(ii) It is now given that the curve has a stationary point at $(2, 3)$. Find the values of a and b . [5]

[illegible]



- [illegible]

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27. Question part 2/2 | 9709 Oct-Nov 2018 P1 V3 Q10

(ii) Find the equation of the normal to the curve at A , giving your answer in the form $y = mx + c$. [5]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

28. Question | 9709 Feb-March 2019 P1 V2 Q2

- 2** A curve with equation $y = f(x)$ passes through the points $(0, 2)$ and $(3, -1)$. It is given that $f'(x) = kx^2 - 2x$, where k is a constant. Find the value of k . [5]

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Topical questions | 91 questions

29. Question part 1/2 | 9709 May-June 2019 P1 V1 Q10

10 A curve for which $\frac{d^2y}{dx^2} = 2x - 5$ has a stationary point at (3, 6).

(i) Find the equation of the curve.

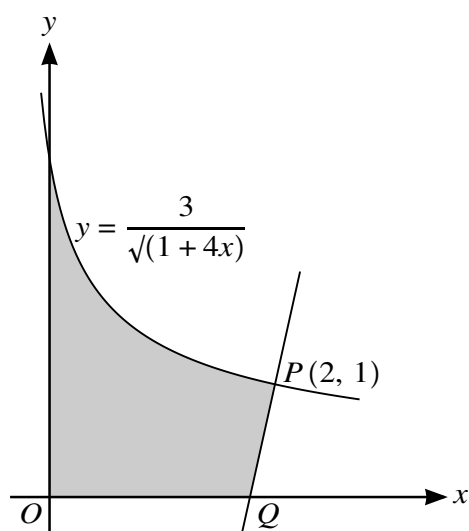
[6]

[illegible]

Topical questions | 91 questions

(ii) Find the x -coordinate of the other stationary point on the curve. [1]

[illegible][illegible]



(i) Show that the x -coordinate of Q is $\frac{16}{9}$. [5]

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Topical questions | 91 questions

30. Question part 2/3 | 9709 May-June 2019 P1 V1 Q11

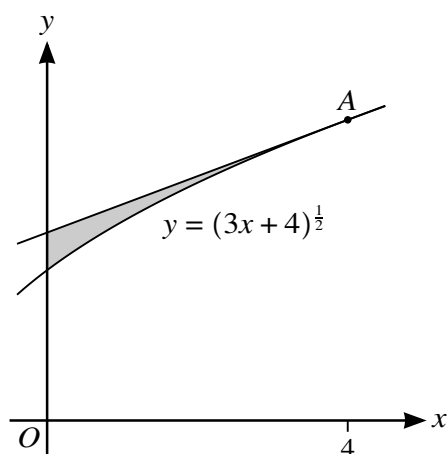
(ii) Find, showing all necessary working, the area of the shaded region.

[6]

Topical questions | 91 questions

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(i) Find the equation of the tangent to the curve at A . [5]

[illegible]

Topical questions | 91 questions

(ii) Find, showing all necessary working, the area of the shaded region.

[5]

[illegible]

[Question 10 (iii) is printed on the next page.]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

31. Question part 3/4 | 9709 May-June 2019 P1 V3 Q10

- (iii) A point is moving along the curve. At the point P the y -coordinate is increasing at half the rate at which the x -coordinate is increasing. Find the x -coordinate of P . [3]

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Topical questions | 91 questions

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[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

32. Question part 1/2 | 9709 Oct-Nov 2019 P1 V1 Q9

- 9** A curve for which $\frac{dy}{dx} = (5x - 1)^{\frac{1}{2}} - 2$ passes through the point $(2, 3)$.

(i) Find the equation of the curve.

[4]

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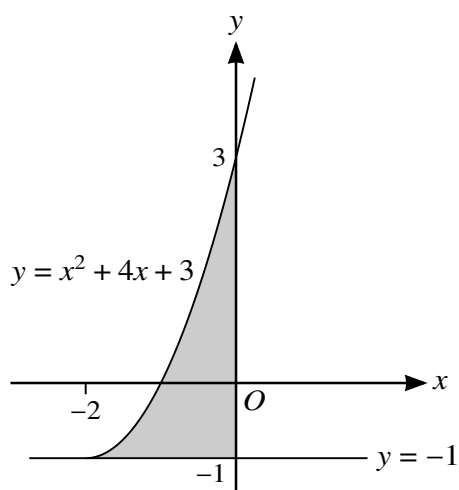
Topical questions | 91 questions

32. Question part 2/2 | 9709 Oct-Nov 2019 P1 V1 Q9

(ii) Find $\frac{d^2y}{dx^2}$. [2]

(iii) Find the coordinates of the stationary point on the curve and, showing all necessary working, determine the nature of this stationary point. [4]

[illegible]



(i) Express $y = x^2 + 4x + 3$ in the form $y = (x + a)^2 + b$, where a and b are constants. Hence, for $x \geq -2$, express x in terms of y . [4]

[illegible]

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33. Question part 2/3 | 9709 Oct-Nov 2019 P1 V1 Q11

- (ii) Hence, showing all necessary working, find the volume obtained when the shaded region is rotated through 360° about the **y-axis**. [6]

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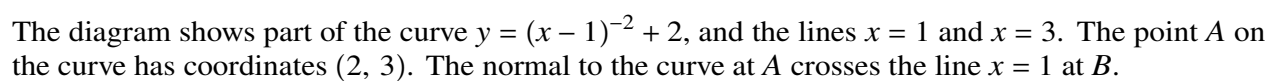
9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

34. Question | 9709 Oct-Nov 2019 P1 V2 Q3

- 3** A curve is such that $\frac{dy}{dx} = \frac{k}{\sqrt{x}}$, where k is a constant. The points $P(1, -1)$ and $Q(4, 4)$ lie on the curve. Find the equation of the curve. [4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



- [illegible]

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Topical questions | 91 questions

35. Question part 2/3 | 9709 Oct-Nov 2019 P1 V3 Q11

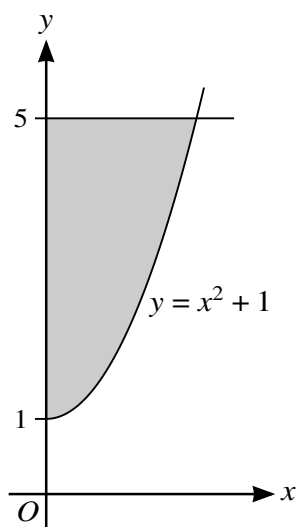
- (ii) Find, showing all necessary working, the volume of revolution obtained when the shaded region is rotated through 360° about the x -axis. [8]

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If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

[illegible]

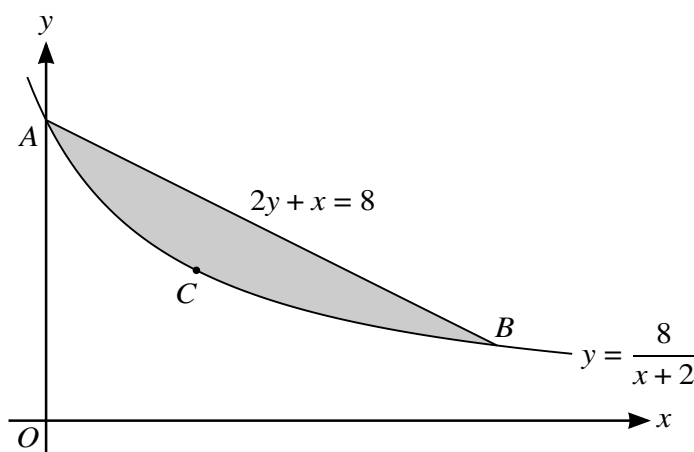
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Find the volume obtained.

[4]

[illegible]



(a) Find, by calculation, the coordinates of A , B and C .

[6]

This image shows a full page of a handwriting practice worksheet. It consists of multiple sets of three horizontal dashed lines, providing a guide for letter height and placement. The lines are evenly spaced across the entire page, which is otherwise blank.

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Topical questions | 91 questions

37. Question part 2/3 | 9709 May-June 2020 P1 V1 Q11

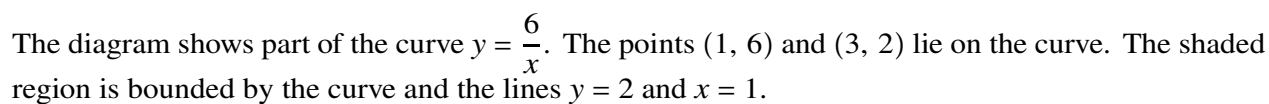
- (b) Find the volume generated when the shaded region, bounded by the curve and the line, is rotated through 360° about the x -axis. [6]

[illegible]

Topical questions | 91 questions

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

[illegible]



- [illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

38. Question part 2/2 | 9709 May-June 2020 P1 V2 Q8

(b) The tangent to the curve at a point X is parallel to the line $y + 2x = 0$. Show that X lies on the line $y = 2x$. [3]

[illegible]

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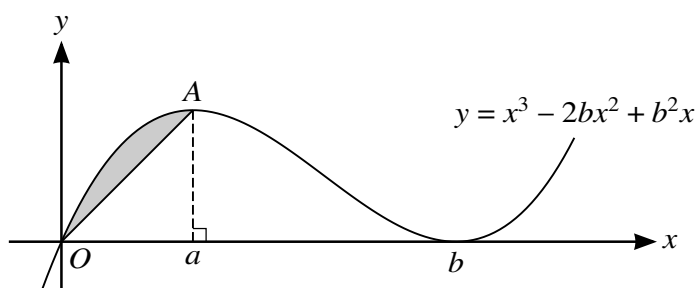
Topical questions | 91 questions

39. Question | 9709 May-June 2020 P1 V3 Q2

- 2** The equation of a curve is such that $\frac{dy}{dx} = 3x^{\frac{1}{2}} - 3x^{-\frac{1}{2}}$. It is given that the point (4, 7) lies on the curve.

Find the equation of the curve. [4]

[illegible]



The diagram shows part of the curve with equation $y = x^3 - 2bx^2 + b^2x$ and the line OA , where A is the maximum point on the curve. The x -coordinate of A is a and the curve has a minimum point at $(b, 0)$, where a and b are positive constants.

- (a) Show that $b = 3a$. [4]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

40. Question part 2/3 | 9709 May-June 2020 P1 V3 Q11

- (b) Show that the area of the shaded region between the line and the curve is ka^4 , where k is a fraction to be found. [7]

[illegible]

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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Topical questions | 91 questions

41. Question | 9709 Oct-Nov 2020 P1 V1 Q2

- 2** The equation of a curve is such that $\frac{dy}{dx} = \frac{1}{(x-3)^2} + x$. It is given that the curve passes through the point (2, 7).

Find the equation of the curve.

[4]

[illegible]

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Topical questions | 91 questions

42. Question | 9709 Oct-Nov 2020 P1 V3 Q2

2 The function f is defined by $f(x) = \frac{2}{(x+2)^2}$ for $x > -2$.

(a) Find $\int_1^{\infty} f(x) \, dx$. [3]

[illegible]

(b) The equation of a curve is such that $\frac{dy}{dx} = f(x)$. It is given that the point $(-1, -1)$ lies on the curve.

Find the equation of the curve. [2]

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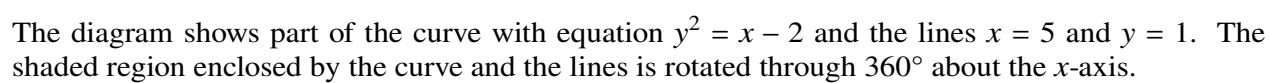
Topical questions | 91 questions

43. Question | 9709 May-June 2021 P1 V1 Q1

- 1** The equation of a curve is such that $\frac{dy}{dx} = \frac{3}{x^4} + 32x^3$. It is given that the curve passes through the point $(\frac{1}{2}, 4)$.

Find the equation of the curve. [4]

[illegible]



Find the volume obtained. [6]

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Topical questions | 91 questions

44. Question part 2/2 | 9709 May-June 2021 P1 V2 Q9

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Topical questions | 91 questions

45. Question part 1/2 | 9709 May-June 2021 P1 V2 Q11

- 11** The gradient of a curve is given by $\frac{dy}{dx} = 6(3x - 5)^3 - kx^2$, where k is a constant. The curve has a stationary point at $(2, -3.5)$.

(a) Find the value of k . [2]

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(b) Find the equation of the curve. [4]

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Topical questions | 91 questions

45. Question part 2/2 | 9709 May-June 2021 P1 V2 Q11

(c) Find $\frac{d^2y}{dx^2}$. [2]

[illegible]

(d) Determine the nature of the stationary point at $(2, -3.5)$. [2]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

46. Question | 9709 May-June 2021 P1 V3 Q1

- 1** A curve with equation $y = f(x)$ is such that $f'(x) = 6x^2 - \frac{8}{x^2}$. It is given that the curve passes through the point $(2, 7)$.

Find $f(x)$. [3]

This image shows a full page of a worksheet designed for handwriting practice. It features approximately 20 horizontal rows. Each row is defined by two parallel dashed lines, creating a series of uniform gaps for letter height. The entire page is otherwise blank, with no margins, text, or other markings.

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

47. Question part 1/2 | 9709 Oct-Nov 2021 P1 V1 Q9

9 A curve has equation $y = f(x)$, and it is given that $f'(x) = 2x^2 - 7 - \frac{4}{x^2}$.

(a) Given that $f(1) = -\frac{1}{3}$, find $f(x)$. [4]

[illegible]

(b) Find the coordinates of the stationary points on the curve. [5]

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(c) Find $f''(x)$. [1]

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(d) Hence, or otherwise, determine the nature of each of the stationary points. [2]

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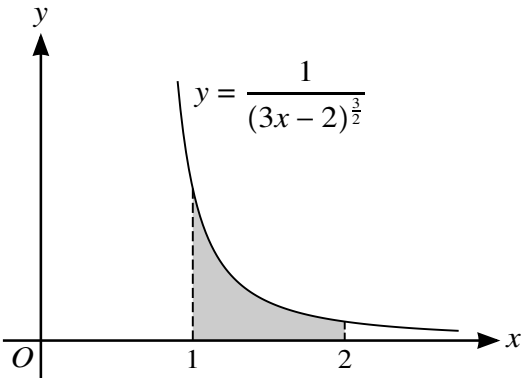
48. Question part 1/3 | 9709 Oct-Nov 2021 P1 V1 Q10

10

(a)

Find $\int_1 \frac{1}{(3x - 2)^{\frac{3}{2}}} dx$.

[4]



The diagram shows the curve with equation $y = \frac{1}{(3x - 2)^{\frac{3}{2}}}$. The shaded region is bounded by the curve, the x -axis and the lines $x = 1$ and $x = 2$. The shaded region is rotated through 360° about the x -axis.

(b)

Find the volume of revolution.

[4]

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48. Question part 2/3 | 9709 Oct-Nov 2021 P1 V1 Q10

[illegible]

The normal to the curve at the point $(1, 1)$ crosses the y -axis at the point A .

(c) Find the y -coordinate of A .

[4]

[illegible]

Topical questions | 91 questions

Additional Page

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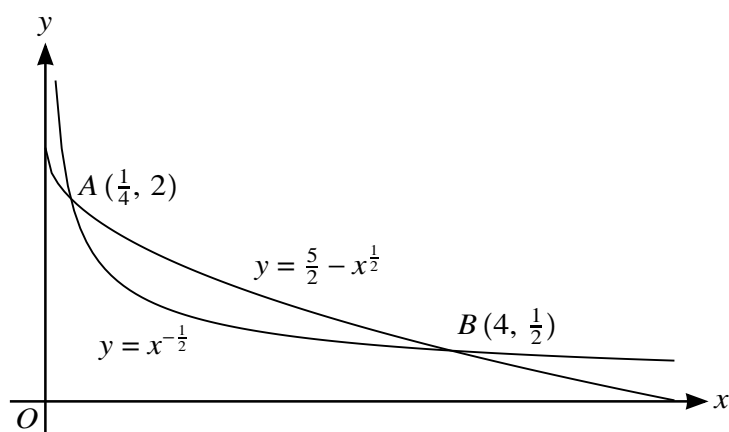
49. Question | 9709 Oct-Nov 2021 P1 V2 Q4

- 4** A curve is such that $\frac{dy}{dx} = \frac{8}{(3x+2)^2}$. The curve passes through the point $(2, 5\frac{2}{3})$.

Find the equation of the curve.

[4]

[illegible]



(a) Find the area of the region between the two curves.

[6]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

50. Question part 2/2 | 9709 Oct-Nov 2021 P1 V3 Q8

(b) The normal to the curve $y = x^{-\frac{1}{2}}$ at the point $(1, 1)$ intersects the y -axis at the point $(0, p)$.

Find the value of p .

[4]

[illegible]

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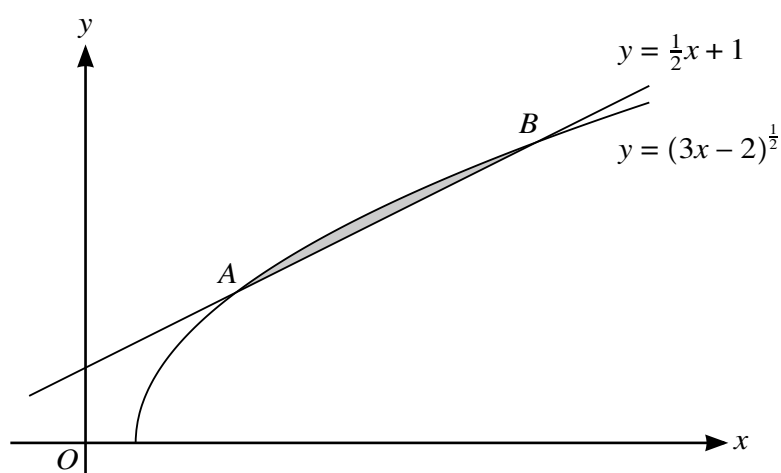
Topical questions | 91 questions

51. Question | 9709 Feb-March 2022 P1 V2 Q1

- 1** A curve with equation $y = f(x)$ is such that $f'(x) = 2x^{-\frac{1}{3}} - x^{\frac{1}{3}}$. It is given that $f(8) = 5$.

Find $f(x)$. [4]

[illegible]



(a) Find the coordinates of A and B . [4]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

52. Question part 2/2 | 9709 May-June 2022 P1 V1 Q7

(b) Hence find the area of the region enclosed between the curve and the line.

[5]

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Topical questions | 91 questions

10 The equation of a curve is such that $\frac{d^2y}{dx^2} = 6x^2 - \frac{4}{x^3}$. The curve has a stationary point at $(-1, \frac{9}{2})$.

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- This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings on the page.

Topical questions | 91 questions

(c) Show that the curve has no other stationary points. [3]

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- Find the rate of increase of the x -coordinate of A at the point where $x = 1$. [3]

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[illegible]

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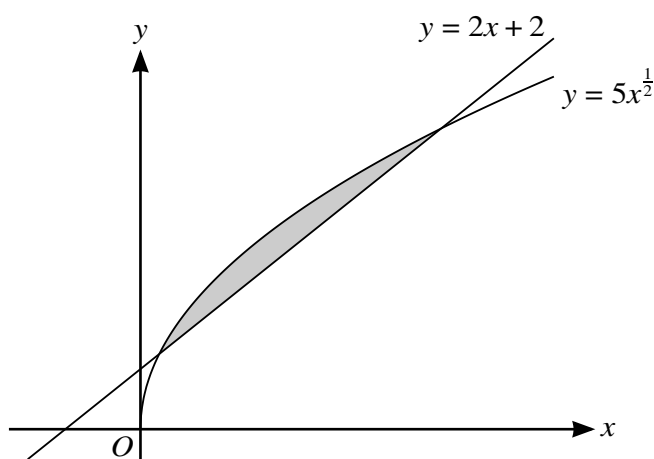
Topical questions | 91 questions

54. Question | 9709 May-June 2022 P1 V2 Q3

- 3** The equation of a curve is such that $\frac{dy}{dx} = 3(4x - 7)^{\frac{1}{2}} - 4x^{-\frac{1}{2}}$. It is given that the curve passes through the point $(4, \frac{5}{2})$.

Find the equation of the curve. [4]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



Find the exact area of the shaded region which is bounded by the line and the curve. [5]

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Topical questions | 91 questions

55. Question part 2/2 | 9709 May-June 2022 P1 V2 Q6

[illegible]

Topical questions | 91 questions

10 The function f is defined by $f(x) = (4x + 2)^{-2}$ for $x > -\frac{1}{2}$.

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Topical questions | 91 questions

A point is moving along the curve $y = f(x)$ in such a way that, as it passes through the point A , its y -coordinate is **decreasing** at the rate of k units per second and its x -coordinate is **increasing** at the rate of k units per second.

(b) Find the coordinates of A. [6]

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Topical questions | 91 questions

2 The equation of a curve is such that $\frac{dy}{dx} = 12\left(\frac{1}{2}x - 1\right)^{-4}$. It is given that the curve passes through the point $P(6, 4)$.

This image shows a full page of primary-ruled paper. It features ten sets of horizontal lines across the page. Each set consists of three lines: a solid black line at the top, a dashed black line in the middle, and another solid black line at the bottom. The lines are evenly spaced and extend from the left margin to the right edge of the page. There is no handwriting or other markings on the paper.

[illegible]

Topical questions | 91 questions

8 The equation of a curve is such that $\frac{dy}{dx} = 3x^{\frac{1}{2}} - 3x^{-\frac{1}{2}}$. The curve passes through the point (3, 5).

[illegible]

(b) Find the x -coordinate of the stationary point. [2]

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(c) State the set of values of x for which y increases as x increases. [1]

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11 (a) Find the coordinates of the minimum point of the curve $y = \frac{9}{4}x^2 - 12x + 18$. [3]

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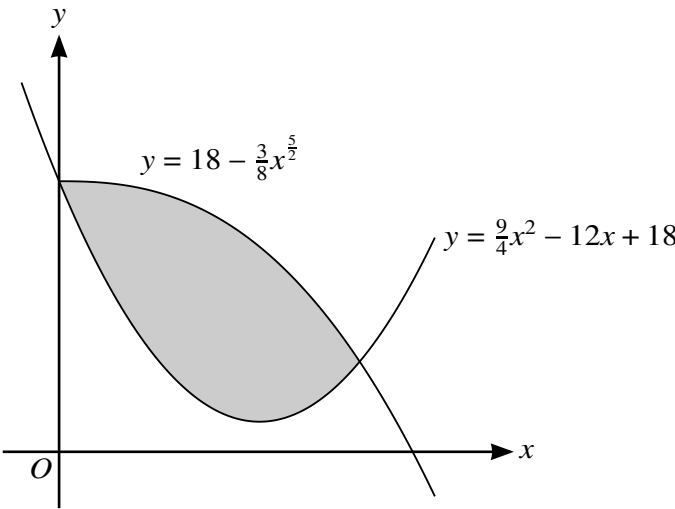
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The diagram shows the curves with equations $y = \frac{9}{4}x^2 - 12x + 18$ and $y = 18 - \frac{3}{8}x^{\frac{5}{2}}$. The curves intersect at the points (0, 18) and (4, 6).

(b) Find the area of the shaded region. [5]

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9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

59. Question part 2/3 | 9709 Oct-Nov 2022 P1 V2 Q11

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- (c) A point P is moving along the curve $y = 18 - \frac{3}{8}x^{\frac{5}{2}}$ in such a way that the x -coordinate of P is increasing at a constant rate of 2 units per second.

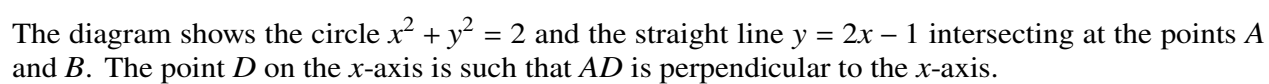
Find the rate at which the y -coordinate of P is changing when $x = 4$. [3]

[illegible]

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[illegible]

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Topical questions | 91 questions

- [illegible]

- [illegible]

Topical questions | 91 questions

10 At the point $(4, -1)$ on a curve, the gradient of the curve is $-\frac{3}{2}$. It is given that $\frac{dy}{dx} = x^{-\frac{1}{2}} + k$, where k is a constant.

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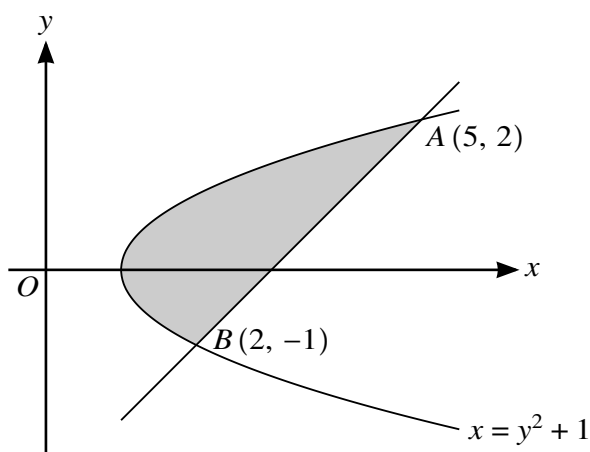
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[illegible]

Topical questions | 91 questions

- [illegible]

- [illegible]



(a) Find an equation of the line AB . [2]

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62. Question part 2/3 | 9709 Feb-March 2023 P1 V2 Q11

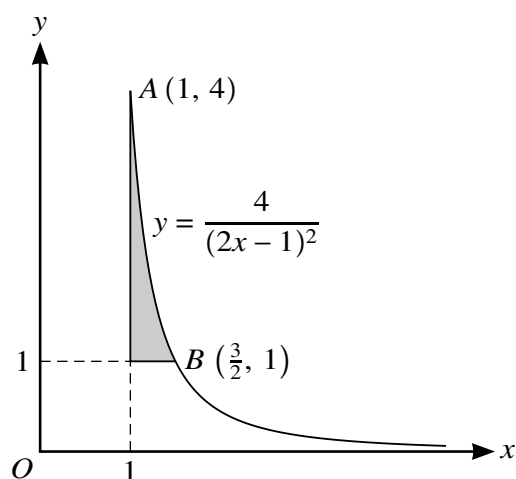
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Topical questions | 91 questions

Additional Page

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(a) Find the exact volume generated when the shaded region is rotated through 360° about the x -axis. [5]

[illegible]

Topical questions | 91 questions

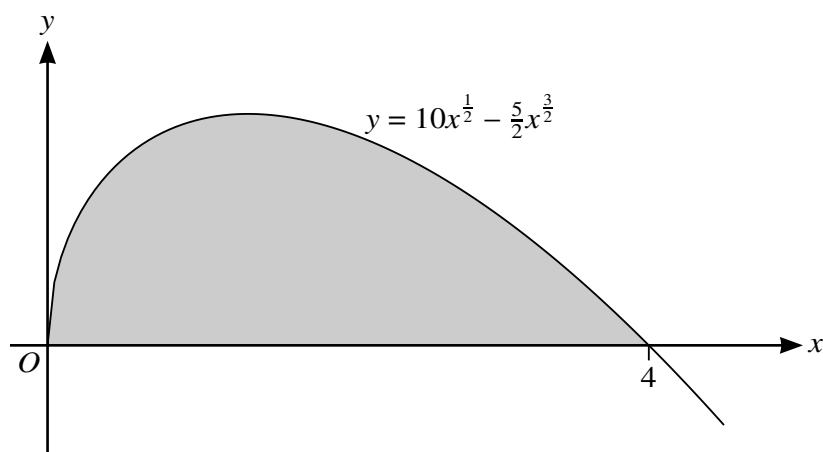
- Find the area of this triangle. [6]

[illegible]

Topical questions | 91 questions

1 The equation of a curve is such that $\frac{dy}{dx} = \frac{4}{(x-3)^3}$ for $x > 3$. The curve passes through the point $(4, 5)$.

[illegible]



Find the area of the shaded region. [4]

[illegible]

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Topical questions | 91 questions

66. Question part 1/2 | 9709 May-June 2023 P1 V3 Q9

9 A curve which passes through $(0, 3)$ has equation $y = f(x)$. It is given that $f'(x) = 1 - \frac{2}{(x-1)^3}$.

(a) Find the equation of the curve. [4]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

66. Question part 2/2 | 9709 May-June 2023 P1 V3 Q9

The tangent to the curve at $(0, 3)$ intersects the curve again at one other point, P .

(b) Show that the x -coordinate of P satisfies the equation $(2x + 1)(x - 1)^2 - 1 = 0$. [4]

[illegible]

(c) Verify that $x = \frac{3}{2}$ satisfies this equation and hence find the y-coordinate of P . [2]

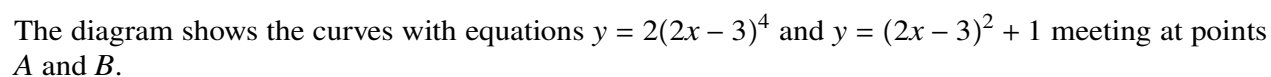
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- [illegible]

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Topical questions | 91 questions

67. Question part 2/2 | 9709 Oct-Nov 2023 P1 V1 Q8

(b) Find the exact area of the shaded region.

[5]

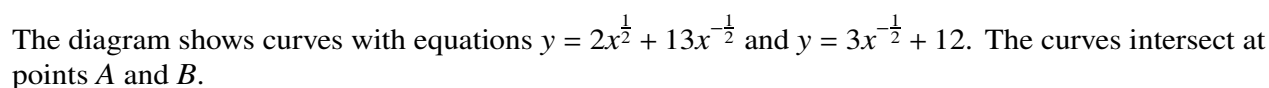
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Topical questions | 91 questions

3 The equation of a curve is such that $\frac{dy}{dx} = \frac{1}{2}x + \frac{72}{x^4}$. The curve passes through the point $P(2, 8)$.

[illegible]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



- [illegible]

Topical questions | 91 questions

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[5]

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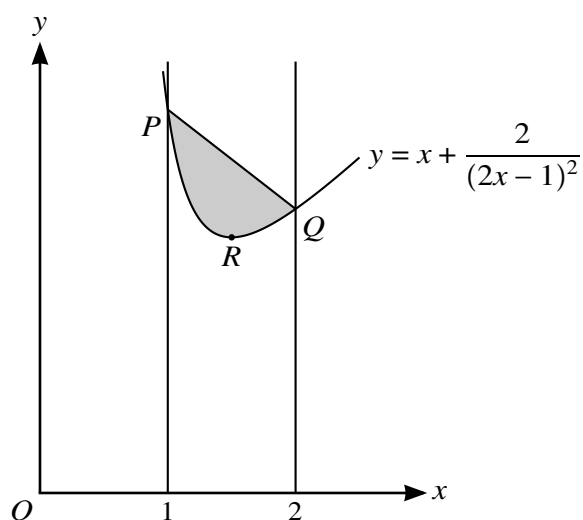
70. Question | 9709 Oct-Nov 2023 P1 V3 Q1

- 1** A curve is such that its gradient at a point (x, y) is given by $\frac{dy}{dx} = x - 3x^{-\frac{1}{2}}$. It is given that the curve passes through the point $(4, 1)$.

Find the equation of the curve.

[4]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no other markings or text present.



(a) Verify that the x -coordinate of R is $\frac{3}{2}$ and find the y -coordinate of R . [4]

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9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

71. Question part 2/3 | 9709 Oct-Nov 2023 P1 V3 Q11

(b) Find the exact value of the area of the shaded region.

[6]

[illegible]

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[illegible]

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Topical questions | 91 questions

72. Question | 9709 Feb-March 2024 P1 V2 Q1

1 Find the exact value of $\int_3^{\infty} \frac{2}{x^2} dx$. [3]

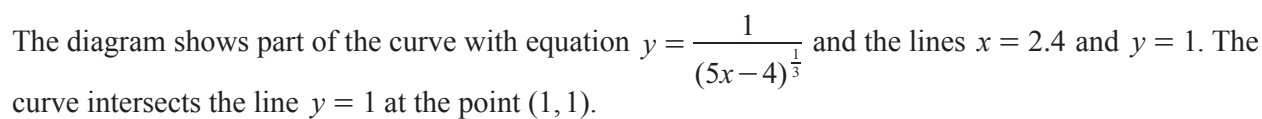
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Topical questions | 91 questions

3 A curve is such that $\frac{dy}{dx} = 3(4x + 5)^{\frac{1}{2}}$. It is given that the points $(1, 9)$ and $(5, a)$ lie on the curve.

Find the value of a . [5]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



Find the exact volume of the solid generated when the shaded region is rotated through 360° about the x -axis. [6]

[illegible]

9709 Mathematics Paper 1 - Integration

Topical questions | 91 questions

74. Question part 2/2 | 9709 May-June 2024 P1 V1 Q9

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Topical questions | 91 questions

75. Question | 9709 May-June 2024 P1 V3 Q6

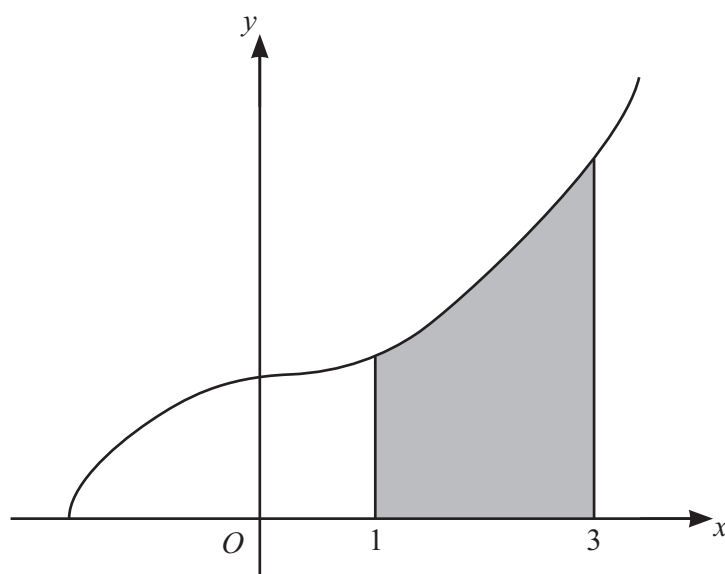
(a) Find the equation of the curve. [4]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Find the equation of the new curve. [3]

[illegible]

9



(a) Find the equation of the tangent to the curve at the point where $x = 3$. Give your answer in the form $ax + by + c = 0$ where a , b and c are integers. [5]

[illegible]



- Find the volume of the solid obtained when the shaded region is rotated through 360° about the x -axis. [3]

[illegible]



Topical questions | 91 questions

5 The equation of a curve is such that $\frac{dy}{dx} = 4x - 3\sqrt{x} + 1$.

[illegible][illegible]

[illegible]

A graph showing the function $y = e^x$ and its tangent line at the origin. The curve $y = e^x$ is shown in black, and the tangent line is shown in red. The region between the curve and the tangent line is shaded in light blue. The origin is labeled O .

Find the area of the shaded region. [5]

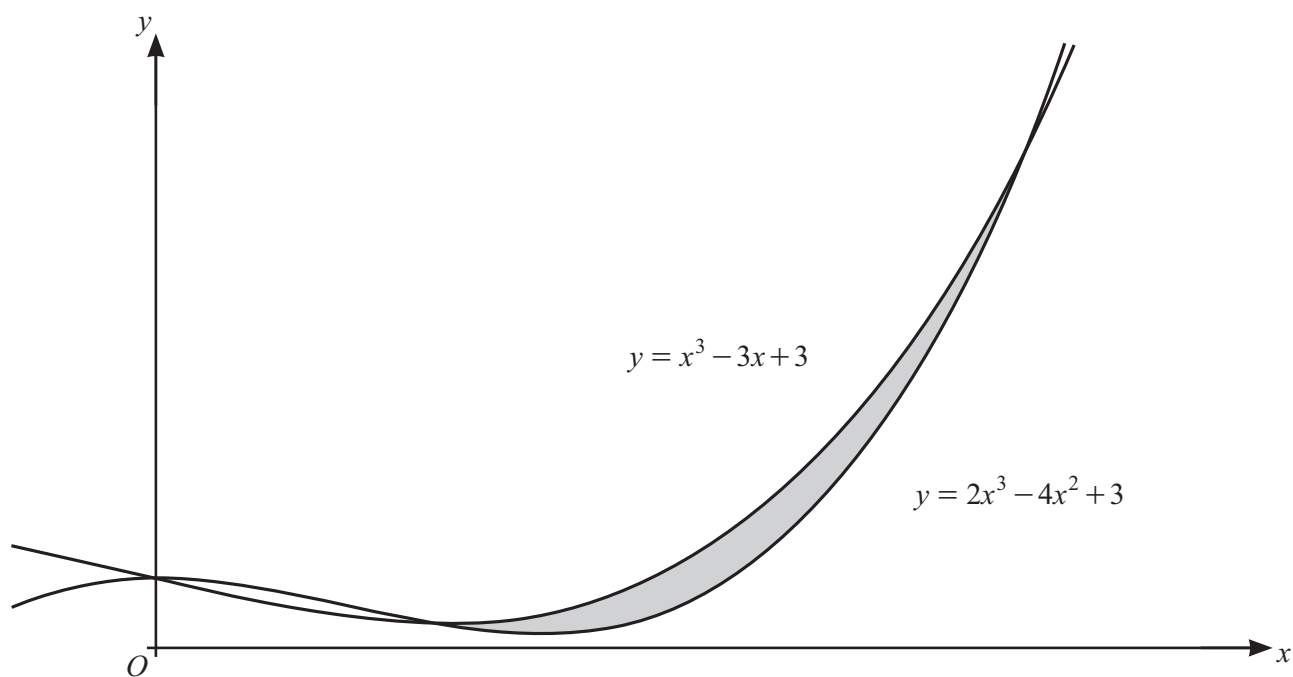
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Topical questions | 91 questions

78. Question part 2/2 | 9709 Oct-Nov 2024 P1 V2 Q7

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.



(a) Find the x -coordinates of the points of intersection of the curves. [3]

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9709 Mathematics Paper 1 - Integration

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79. Question part 2/2 | 9709 Oct-Nov 2024 P1 V3 Q9



(b) Find the area of the shaded region.

[4]

[illegible]

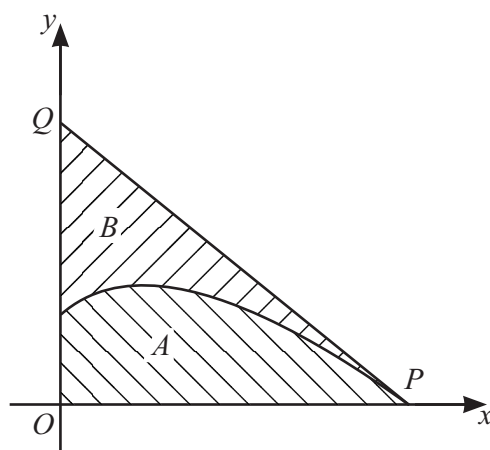
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9 A curve is such that $\frac{d^2y}{dx^2} = \frac{6}{x^4} - \frac{5}{x^3}$. It is given that the curve has a stationary point at $(\frac{1}{2}, 9)$.

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- [illegible]

10


$$y = 4(3x + 4)^{\frac{1}{2}} - 2x - 6$$

for values of x such that $0 \leq x \leq 7$. The tangent to the curve at the point $P(7, 0)$ meets the y -axis at the point Q . Region A is bounded by the curve and the two axes. Region B is bounded by the curve, the line segment PQ and the y -axis.

- (a) Find the area of region A . [4]

This image shows a full page of a worksheet designed for handwriting practice. It features ten sets of horizontal dashed lines spaced evenly down the page. Each set consists of two short dashes followed by a longer dash, creating a guide for letter height and placement. The background is plain white, and there are no margins or additional markings.

9709 Mathematics Paper 1 - Integration

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81. Question part 2/2 | 9709 Feb-March 2025 P1 V2 Q10

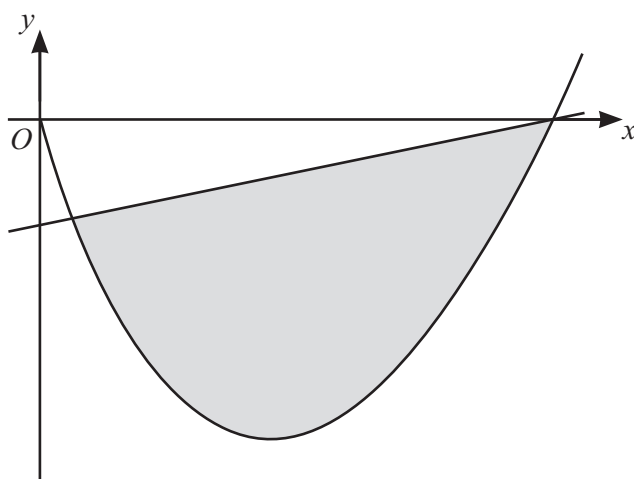


(b) Find the area of region B .

[5]

[illegible]

4

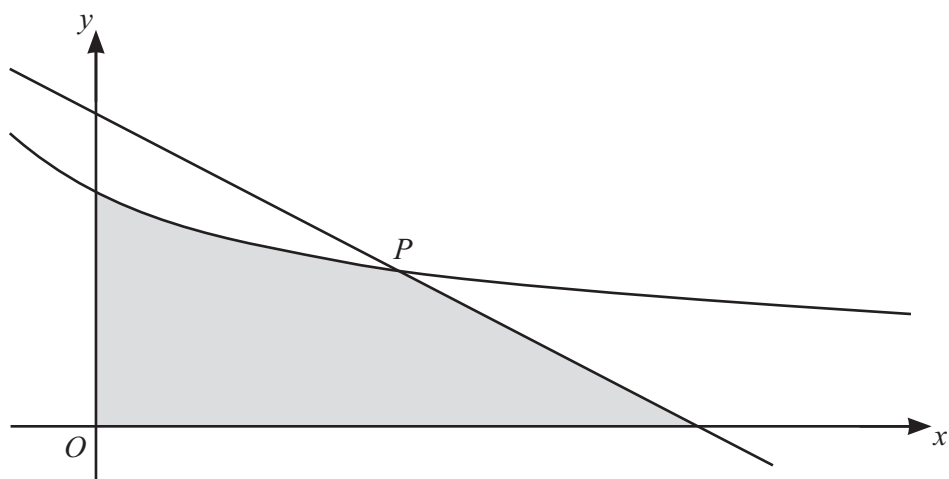


Find the area of the shaded region between the curve and the line.

[5]

[illegible]

6



Find the area of the shaded region.

[6]

[illegible]

9709 Mathematics Paper 1 - Integration

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84. Question | 9709 May-June 2025 P1 V3 Q3

3 Given that $\int_1^5 \left(\frac{a}{(4x-3)^2} + 2 \right) dx = 12$, find the value of the constant a . [4]

This image shows a full page of a worksheet designed for handwriting practice. It consists of approximately 20 horizontal rows. Each row is defined by two parallel dotted lines, creating a series of uniform gaps for writing. The lines are evenly spaced across the entire page, providing a guide for letter height and placement. There is no text or other markings on the page.

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85. Question | 9709 May-June 2025 P1 V5 Q1

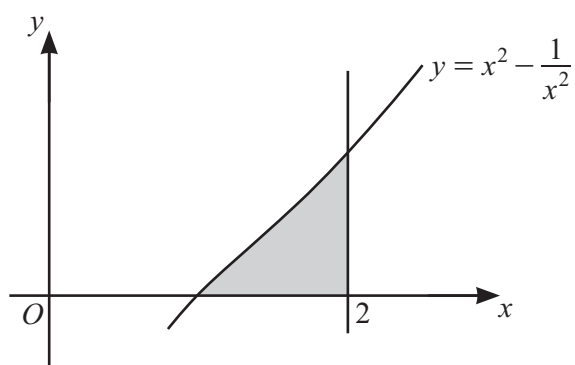
- 1** The equation of a curve is such that $\frac{dy}{dx} = 12(2x - 5)^2 + 8x$. It is given that the curve passes through the point (2, 4).

Find an equation of the curve.

[4]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

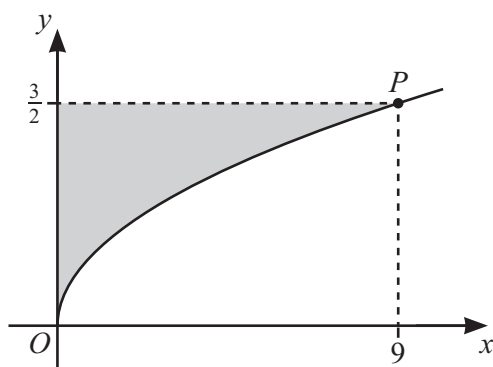
4



Find the volume formed when the shaded region is rotated through 360° about the x -axis, giving your answer correct to 2 decimal places. [5]

[illegible]

8



(a) Find the area of the shaded region. [3]

This image shows a full page of handwriting practice paper. It features 18 horizontal rows, each defined by two parallel dashed lines. The rows are evenly spaced and extend across the entire width of the page, providing a guide for letter height and placement. There is no text or other markings on the page.

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87. Question part 2/2 | 9709 Oct-Nov 2025 P1 V1 Q8



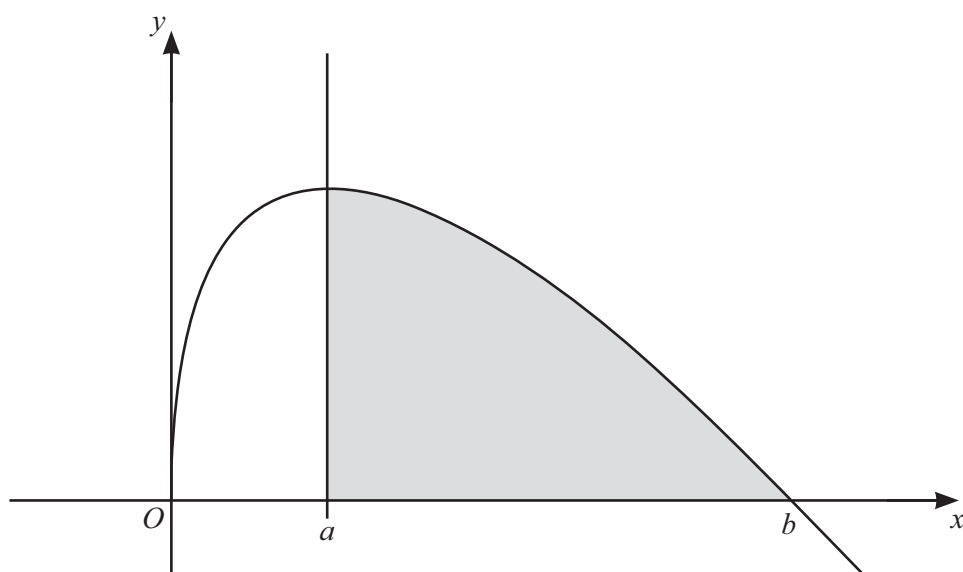
- (b)** The shaded region is rotated through 360° about the **y-axis**.

Find the exact volume of the solid produced.

[4]

[illegible]

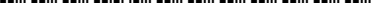
5



(a) Find the value of a . [3]

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

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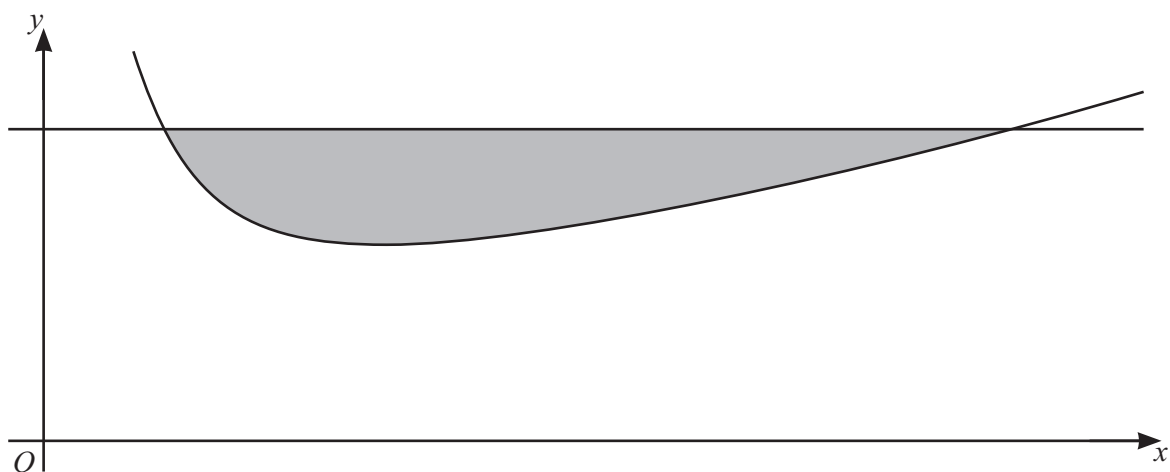


[5]

[illegible]

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9



Find the exact volume of the solid formed when the shaded region is rotated through 360° about the x -axis. [8]

[illegible]

9709 Mathematics Paper 1 - Integration

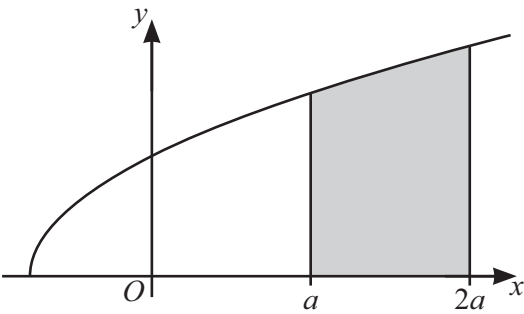
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89. Question part 2/2 | 9709 Oct-Nov 2025 P1 V3 Q9

[illegible]

90. Question | 9709 Oct-Nov 2025 P1 V5 Q8

8



The diagram shows the curve with equation $y = \sqrt{6x + 5}$. The shaded region is bounded by the curve, the x -axis and the lines $x = a$ and $x = 2a$, where a is a positive constant.

The shaded region is rotated through 360° about the x -axis to form a solid. The solid has volume, V , such that $V \geq 46\pi$.

(a) Show that $9a^2 + 5a - 46 \geq 0$. [4]

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(b) Find the range of possible values of a . [3]

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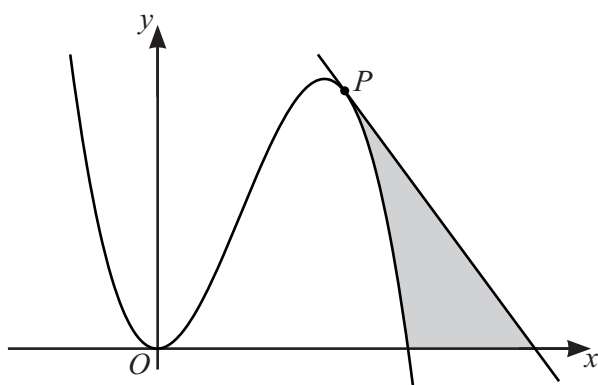
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(a) Find the equation of the tangent to the curve at the point P . Give your answer in the form $y = mx + c$. [5]

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91. Question part 2/3 | 9709 Oct-Nov 2025 P1 V5 Q11



(b) The shaded region is bounded by the curve, the x -axis and the tangent to the curve at P .

Find the exact area of the shaded region. [6]

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The graph of $y = 4x^2 - x^3$ is transformed by a stretch of scale factor $\frac{1}{3}$ in the x -direction. The point Q is the image of P under this transformation. The transformed shaded region is bounded by the transformed curve, the x -axis and the tangent to the transformed curve at Q .

(c) (i) Find the equation of the transformed curve in the form $y = mx^2 + nx^3$, where m and n are integers to be found. [1]

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(c) (ii) State the coordinates of Q and the area of the transformed shaded region. [2]

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Topical questions | 91 questions



If you use the following page to complete the answer to any question, the question number must be clearly shown.

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