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## Integration - Past Edexcel Exam Questions

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1. (Question 2 - C1 May 2018)

Given

$$y = 3\sqrt{x} - 6x + 4, \quad x > 0$$

(a) find  $\int y \, dx$ , simplifying each term. [3]

(b) (*Differentiation Question*)

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2. (Question 9 - C1 May 2018)

The curve  $C$  has equation  $y = f(x)$ , where

$$f'(x) = (x - 3)(3x + 5).$$

Given that the point  $P(1, 20)$  lies on  $C$ ,

(a) find  $f(x)$ , simplifying each term. [5]

(b) Show that  $f(x) = (x - 3)^2(x + A)$  where  $A$  is a constant to be found. [3]

(c) (*Curve Sketching Question*)

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3. (Question 1 - C1 May 2017)

Find

$$\int \left( 2x^5 - \frac{1}{4x^3} - 5 \right) dx$$

giving each term in its simplest form. [4]

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4. (Question 7 - C1 May 2017)

The curve  $C$  has equation  $y = f(x)$ ,  $x > 0$ , where

$$f'(x) = 30 + \frac{6 - 5x^2}{\sqrt{x}}.$$

Given that the point  $P(4, -8)$  lies on  $C$ ,

(a) *(Differentiation Question)*

(b) Find  $f(x)$ , giving each term in its simplest form. [5]

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5. (Question 1 - C1 May 2016)

Find

$$\int \left( 2x^4 - \frac{4}{\sqrt{x}} + 3 \right) dx$$

giving each term in its simplest form. [4]

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6. (Question 3 - C1 May 2015)

Given that  $y = 4x^3 - \frac{5}{x^2}$ ,  $x \neq 0$ , find in their simplest form

(a) *(Differentiation Question)*

(b)  $\int y dx$ . [3]

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7. (Question 10 - C1 May 2015)

A curve with equation  $y = f(x)$  passes through the point  $(4, 9)$ .

Given that

$$f'(x) = \frac{3\sqrt{x}}{2} - \frac{9}{4\sqrt{x}} + 2, \quad x > 0$$

(a) find  $f(x)$ , giving each term in its simplest form. [5]

(b) *(Differentiation Question)*

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8. (Question 1 - C1 May 2014)

Find

$$\int (8x^3 + 4) dx$$

giving each term in its simplest form. [3]

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9. (Question 10 - C1 May 2014)

A curve with equation  $y = f(x)$  passes through the point (4, 25).

Given that

$$f'(x) = \frac{3}{8}x^2 - 10x^{-\frac{1}{2}} + 1, \quad x > 0$$

(a) find  $f(x)$ , simplifying each term. [5]

(b) *(Differentiation Question)*

10. (Question 2 - C1 May 2013)

Find

$$\int \left( 10x^4 - 4x - \frac{3}{\sqrt{x}} \right) dx$$

giving each term in its simplest form. [4]

11. (Question 9 - C1 May 2013)

$$f'(x) = \frac{(3 - x^2)^2}{x^2}, \quad x \neq 0$$

(a) Show that

$$f'(x) = 9x^{-2} + A + Bx^2$$

where  $A$  and  $B$  are constants to be found. [3]

(b) *(Differentiation Question)*

Given that the point  $(-3, 10)$  lies on the curve with equation  $y = f(x)$ ,

(c) find  $f(x)$ . [5]

12. (Question 8 - C1 January 2013)

$$\frac{dy}{dx} = -x^3 + \frac{4x - 5}{2x^3}, \quad x \neq 0$$

Given that  $y = 7$  at  $x = 1$ , find  $y$  in terms of  $x$ , giving each term in its simplest form. [6]

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13. (Question 1 - C1 May 2012)

Find

$$\int \left( 6x^2 + \frac{2}{x^2} + 5 \right) dx$$

giving each term in its simplest form. [4]

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14. (Question 7 - C1 May 2012)

The point  $P(4, -1)$  lies on the curve  $C$  with equation  $y = f(x)$ ,  $x > 0$ , and

$$f'(x) = \frac{1}{2}x - \frac{6}{\sqrt{x}} + 3.$$

(a) (*Differentiation Question*)

(b) Find  $f(x)$ . [4]

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15. (Question 1 - C1 January 2012)

Given that  $y = x^4 + 6x^{\frac{1}{2}}$ , find in their simplest form

(a) (*Differentiation Question*)

(b)  $\int y dx$ . [3]

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16. (Question 7 - C1 January 2012)

A curve with equation  $y = f(x)$  passes through the point  $(2, 10)$ . Given that

$$f'(x) = 3x^2 - 3x + 5,$$

find the value of  $f(1)$ . [5]

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17. (Question 2 - C1 May 2011)

Given that  $y = 2x^5 + 7 + \frac{1}{x^3}$ ,  $x \neq 0$ , find, in their simplest form

(a) *(Differentiation Question)*

(b)  $\int y \, dx$ . [4]

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18. (Question 6 - C1 May 2011)

Given that  $\frac{6x+3x^{\frac{5}{2}}}{\sqrt{x}}$  can be written in the form  $6x^p + 3x^q$ ,

(a) write down the value of  $p$  and the value of  $q$ . [2]

Given that  $\frac{dy}{dx} = \frac{6x+3x^{\frac{5}{2}}}{\sqrt{x}}$  and that  $y = 90$  when  $x = 4$ ,

(b) find  $y$  in terms of  $x$ , simplifying the coefficient of each term. [5]

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19. (Question 2 - C1 January 2011)

Find

$$\int (12x^5 - 3x^2 + 4x^{\frac{1}{3}}) \, dx,$$

giving each term in its simplest form. [5]

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20. (Question 7 - C1 January 2011)

The curve with equation  $y = f(x)$  passes through the point  $(-1, 0)$ .

Given that

$$f'(x) = 12x^2 - 8x + 1$$

find  $f(x)$ . [5]

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21. (Question 2 - C1 May 2010)

Find

$$\int (8x^3 + 6x^{\frac{1}{2}} - 5) dx,$$

giving each term in its simplest form. [4]

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22. (Question 11 - C1 May 2010)

The curve  $C$  has equation  $y = f(x)$ ,  $x > 0$ , where

$$\frac{dy}{dx} = 3x - \frac{5}{\sqrt{x}} - 2.$$

Given that the point  $P(4, 5)$  lies on  $C$ , find

(a)  $f(x)$ , [5]

(b) (*Differentiation Question*)

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23. (Question 4 - C1 January 2010)

$$\frac{dy}{dx} = 5x^{-\frac{1}{2}} + x\sqrt{x}, \quad x > 0$$

Given that  $y = 35$  at  $x = 4$ , find  $y$  in terms of  $x$ , giving each term in its simplest form. [7]

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24. (Question 3 - C1 June 2009)

Given that  $y = 2x^3 + \frac{3}{x^2}$ ,  $x \neq 0$ , find

(a) *(Differentiation Question)*

(b)  $\int y \, dx$ , simplifying each term. [3]

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25. (Question 2 - C1 January 2009)

Find  $\int (12x^5 - 8x^3 + 3) \, dx$ , giving each term in its simplest form. [4]

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26. (Question 4 - C1 January 2009)

A curve has equation  $y = f(x)$  and passes through the point (4, 22).

Given that

$$f'(x) = 3x^2 - 3x^{\frac{1}{2}} - 7,$$

use integration to find  $f(x)$ , giving each term in its simplest form. [5]

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27. (Question 1 - C1 June 2008)

Find  $\int (2 + 5x^2) \, dx$ . [3]

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28. (Question 11 - C1 June 2008)

The gradient of a curve  $C$  is given by  $\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}$ ,  $x \neq 0$ .

(a) *(Differentiation Question)*

The point (3,20) lies on  $C$ .

(b) Find an equation for the curve  $C$  in the form  $y = f(x)$ . [6]

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29. (Question 1 - C1 January 2008)

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

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30. (Question 9 - C1 January 2008)

The curve  $C$  has equation  $y = f(x)$ ,  $x > 0$ , and  $f'(x) = 4x - 6\sqrt{x} + \frac{8}{x^2}$ .

Given that the point  $P(4, 1)$  lies on  $C$ ,

(a) find  $f(x)$  and simplify your answer. [6]

(b) (*Differentiation Question*)

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31. (Question 3 - C1 May 2007)

Given that  $y = 3x^2 + 4\sqrt{x}$ ,  $x > 0$ , find

(a) (*Differentiation Question*)

(b) (*Differentiation Question*)

(c)  $\int y dx$ . [3]

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32. (Question 9 - C1 May 2007)

The curve  $C$  with equation  $y = f(x)$  passes through the point  $(5, 65)$ .

Given that  $f'(x) = 6x^2 - 10x - 12$ ,

(a) use integration to find  $f(x)$ . [4]

(b) Hence show that  $f(x) = x(2x + 3)(x - 4)$ . [2]

(c) (*Curve Sketching Question*)

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33. (Question 6 - C1 January 2007)

(a) Show that  $(4 + 3\sqrt{x})^2$  can be written as  $16 + k\sqrt{x} + 9x$ , where  $k$  is a constant to be found. [2]

(b) Find  $\int (4 + 3\sqrt{x})^2 dx$ . [3]

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34. (Question 7 - C1 January 2007)

The curve  $C$  has equation  $y = f(x)$ ,  $x \neq 0$ , and the point  $P(2, 1)$  lies on  $C$ . Given that

$$f'(x) = 3x^2 - 6 - \frac{8}{x^2},$$

(a) find  $f(x)$ . [5]

(b) *(Differentiation Question)*

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35. (Question 1 - C1 May 2006)

Find  $\int (6x^2 + 2 + x^{-\frac{1}{2}}) dx$ , giving each term in its simplest form. [4]

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36. (Question 10 - C1 May 2006)

The curve  $C$  with equation  $y = f(x)$ ,  $x \neq 0$ , passes through the point  $(3, 7\frac{1}{2})$ .

Given that  $f'(x) = 2x + \frac{3}{x^2}$ ,

(a) find  $f(x)$ . [5]

(b) Verify that  $f(-2) = 5$ . [1]

(c) *(Differentiation Question)*

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37. (Question 4 - C1 January 2006)

Given that  $y = 2x^2 - \frac{6}{x^3}$ ,  $x \neq 0$ ,

(a) *(Differentiation Question)*

(b) find  $\int y dx$ . [3]

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38. (Question 8 - C1 January 2006)

The curve with equation  $y = f(x)$  passes through the point (1,6). Given that

$$f'(x) = 3 + \frac{5x^2 + 2}{x^{\frac{1}{2}}}, \quad x > 0,$$

find  $f(x)$  and simplify your answer. [7]

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39. (Question 2 - C1 May 2005)

Given that  $y = 6x - \frac{4}{x^2}$ ,  $x \neq 0$ ,

(a) *(Differentiation Question)*

(b) find  $\int y \, dx$ . [3]

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40. (Question 7 - C1 May 2005)

(a) Show that  $\frac{(3-\sqrt{x})^2}{\sqrt{x}}$  can be written as  $9x^{-\frac{1}{2}} - 6 + x^{\frac{1}{2}}$ . [2]

Given that  $\frac{dy}{dx} = \frac{(3-\sqrt{x})^2}{\sqrt{x}}$ ,  $x > 0$ , and that  $y = \frac{2}{3}$  at  $x = 1$ ,

(b) find  $y$  in terms of  $x$ . [6]

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## Solutions

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1. (a)  $2x^{\frac{3}{2}} - 3x^2 + 4x + c$   
(b) *(Differentiation Question)*
2. (a)  $f(x) = x^3 - 2x^2 - 15x + 36$   
(b)  $A = 4$   
(c) *(Curve Sketching Question)*
3.  $\frac{1}{3}x^6 + \frac{1}{8}x^{-2} - 5x + c.$
4. (a) *(Differentiation Question)*  
(b)  $30x + 12x^{\frac{1}{2}} - 2x^{\frac{5}{2}} - 88$
5.  $\frac{2}{5}x^5 - 8x^{\frac{1}{2}} + 3x + c.$
6. (a) *(Differentiation Question)*  
(b)  $x^4 + \frac{5}{x} + c$
7. (a)  $f(x) = x^{\frac{3}{2}} - \frac{9}{2}x^{\frac{1}{2}} + 2x + 2$   
(b) *(Differentiation Question)*
8.  $2x^4 + 4x + c$
9. (a)  $f(x) = \frac{1}{8}x^3 - 20x^{\frac{1}{2}} + x + 53$   
(b) *(Differentiation Question)*
10.  $2x^5 - 2x^2 - 6x^{\frac{1}{2}} + c$
11. (a)  $A = -6, B = 1$   
(b) *(Differentiation Question)*  
(c)  $-9x^{-1} - 6x + \frac{1}{3}x^3 - 2$
12.  $-\frac{1}{4}x^4 - 2x^{-1} + \frac{5}{4}x^{-2} + 8$
13.  $2x^3 - 2x^{-1} + 5x + c$
14. (a) *(Differentiation Question)*  
(b)  $\frac{1}{4}x^2 - 12x^{\frac{1}{2}} + 3x + 7$

15. (a) -  
 (b)  $\frac{1}{5}x^5 + 4x^{\frac{3}{2}} + c$
16.  $\frac{5}{2}$
17. (a) -  
 (b)  $\frac{1}{3}x^6 + 7x - \frac{1}{2}x^{-2} + c$
18. (a)  $p = \frac{1}{2}, q = 2$   
 (b)  $y = 4x^{\frac{3}{2}} + x^3 - 6$
19.  $2x^6 - x^3 + 3x^{\frac{4}{3}} + c$
20.  $f(x) = 4x^3 - 4x^2 + x + 9$
21.  $2x^4 + 4x^{\frac{3}{2}} - 5x + c$
22. (a)  $y = \frac{3}{2}x^2 - 10x^{\frac{1}{2}} - 2x + 9$   
 (b) *(Differentiation Question)*
23.  $y = 10x^{\frac{1}{2}} + \frac{2}{5}x^{\frac{5}{2}} + \frac{11}{5}$
24. (a) *(Differentiation Question)*  
 (b)  $\frac{1}{2}x^4 - 3x^{-1} + c$
25.  $2x^6 - 2x^4 + 3x + c$
26.  $f(x) = x^3 - 2x^{\frac{3}{2}} - 7x + 2$
27.  $2x + \frac{5}{3}x^3 + c$
28. (a) *(Differentiation Question)*  
 (b)  $y = \frac{1}{3}x^3 + 6x - 9x^{-1} - 4$
29.  $x^3 + \frac{2}{3}x^6 - 7x + c$
30. (a)  $f(x) = 2x^2 - 4x^{\frac{3}{2}} - 8x^{-1} + 3$   
 (b) *(Differentiation Question)*
31. (a) -  
 (b) -

- (c)  $x^3 + \frac{8}{3}x^{\frac{3}{2}} + c$
32. (a)  $f(x) = 2x^3 - 5x^2 - 12x$   
(b) -  
(c) *(Curve Sketching Question)*
33. (a)  $k = 24$   
(b)  $16x + 16x^{\frac{3}{2}} + \frac{9}{2}x^2 + c$
34. (a)  $f(x) = x^3 - 6x + 8x^{-1} + 1$   
(b) *(Differentiation Question)*
35.  $2x^3 + 2x + 2x^{\frac{1}{2}} + c$
36. (a)  $f(x) = x^2 - 3x^{-1} - \frac{1}{2}$   
(b) -  
(c) *(Differentiation Question)*
37. (a) *(Differentiation Question)*  
(b)  $\frac{2}{3}x^3 + 3x^{-2} + c$
38.  $f(x) = 3x + 2x^{\frac{5}{2}} + 4x^{\frac{1}{2}} - 3$
39. (a) *(Differentiation Question)*  
(b)  $3x^2 + 4x^{-1} + c$
40. (a) -  
(b)  $y = 18x^{\frac{1}{2}} - 6x + \frac{2}{3}x^{\frac{3}{2}} - 12$