10. (i) Find $\int \frac{2x-1}{4\sqrt{x}}\,dx$ writing your answer in simplest form.

(5)

(ii) A curve C has equation $y = f(x)$.

Given

- $f'(x) = ax^2 + b$, where a and b are constants
- the gradient of C at the point $(3, 5)$ is 4
- the y intercept of C is -5

find $f(x)$

(5)

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

(a) $\frac{dy}{dx}$,

(3)

(b) $\int y \, dx$

(3)

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

Given that

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

find $f(x)$, simplifying each term.

(5)

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Answer ALL questions. Write your answers in the spaces provided.

1. Find

$$\int\left(\frac{2}{3}x^3 - \frac{1}{2x^3} + 5\right)\mathrm{d}x$$

simplifying your answer.

(4)

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12. The curve with equation $y = f(x), x > 0,$ passes through the point $P(4, -2)$.

Given that

$$\frac{dy}{dx} = 3x\sqrt{x} - 10x^{-\frac{1}{2}}$$

(a) find the equation of the tangent to the curve at P, writing your answer in the form $y = mx + c$, where m and c are integers to be found.

(4)

(b) Find $f(x)$.

(5)

4. Find

$$\int \frac{4x^2 + 1}{2\sqrt{x}} \, dx$$

giving the answer in its simplest form.

(5)

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8. The curve C with equation $y = f(x), \quad x > 0,$ passes through the point $P(4, 1)$.

Given that $f'(x) = 4\sqrt{x} - 2 - \dfrac{8}{3x^2}$

(a) find the equation of the normal to C at P. Write your answer in the form $ax + by + c = 0,$ where a, b and c are integers to be found.

(4)

(b) Find $f(x)$.

(5)

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11. A curve has equation $y = f(x)$.

The point $P\left(4, \frac{32}{3}\right)$ lies on the curve.

Given that

- $f''(x) = \frac{4}{\sqrt{x}} - 3$
- $f'(x) = 5$ at P

find

(a) the equation of the tangent to the curve at P, writing your answer in the form $y = mx + c$, where m and c are constants to be found,

(2)

(b) $f(x)$.

(8)

1. Find, in simplest form,

$$\int \left(\frac{8x^3}{3} - \frac{1}{2\sqrt{x}} - 5 \right) \mathrm{d}x$$

(4)

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11. A curve has equation $y = f(x)$, where

$$f''(x) = \frac{6}{\sqrt{x^3}} + x \qquad x > 0$$

The point $P(4, -50)$ lies on the curve.

Given that $f'(x) = -4$ at P,

(a) find the equation of the normal at P, writing your answer in the form $y = mx + c$, where m and c are constants,

(3)

(b) find $f(x)$.

(8)

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9. A curve with equation $y = f(x)$ passes through the point (9, 10).

Given that

$$f'(x) = 27x^2 - \frac{21x^3 - 5x}{2\sqrt{x}} \qquad x > 0$$

find $f(x)$, fully simplifying each term.

(6)

9. (i) Find

$$\int \frac{(3x+2)^2}{4\sqrt{x}}\,\mathrm{d}x \qquad x > 0$$

giving your answer in simplest form.

(5)

(ii) A curve C has equation $y = \mathrm{f}(x)$.

Given

- $\mathrm{f}'(x) = x^2 + ax + b$ where a and b are constants
- the y intercept of C is -8
- the point $P(3,-2)$ lies on C
- the gradient of C at P is 2

find, in simplest form, $\mathrm{f}(x)$.

(6)

4. Find

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

writing each term in simplest form.

(6)

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

Given that

- C passes through the point $P(8, 2)$
- $f'(x) = \frac{32}{3x^2} + 3 - 2\left(\sqrt[3]{x}\right)$

(a) find the equation of the tangent to C at P. Write your answer in the form $y = mx + c$, where m and c are constants to be found.

(3)

(b) Find, in simplest form, $f(x)$.

(5)

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1. Find

$$\int 12x^3 + \frac{1}{6\sqrt{x}} - \frac{3}{2x^4}\,dx$$

giving each term in simplest form.

(5)

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10. A curve has equation $y = f(x), x > 0$

Given that

- $f'(x) = ax - 12x^{\frac{1}{3}}$, where a is a constant
- $f''(x) = 0$ when $x = 27$
- the curve passes through the point $(1, -8)$

(a) find the value of a.

(3)

(b) Hence find $f(x)$.

(4)

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1. Find

$$\int \left(\frac{8x^3}{5} - \frac{2}{3x^4} - 1 \right) \mathrm{d}x$$

giving each term in simplest form.

(4)

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

Given that

- $f'(x) = \dfrac{(x+3)^2}{x\sqrt{x}}$
- the point $P(4, 20)$ lies on C

(a) (i) find the value of the gradient at P

(ii) Hence find the equation of the tangent to C at P, giving your answer in the form $ax + by + c = 0$ where a, b and c are integers to be found.

(4)

(b) Find $f(x)$, simplifying your answer.

(7)

1. Find

$$\int \left(10x^5 + 6x^3 - \frac{3}{x^2}\right) \mathrm{d}x$$

giving your answer in simplest form.

(4)

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7. The curve C has equation $y = f(x),\ x > 0$

Given that

- $f'(x) = \frac{2}{\sqrt{x}} + \frac{A}{x^2} + 3$, where A is a constant
- $f''(x) = 0$ when $x = 4$

(a) find the value of A.

(4)

Given also that

- $f(x) = 8\sqrt{3}$, when $x = 12$

(b) find $f(x)$, giving each term in simplest form.

(5)

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2. Given that

$$(x - 5)(2x + 1)(x + 3) \equiv ax^3 + bx^2 - 32x - 15$$

where a and b are constants,

(a) find the value of a and the value of b.

(2)

(b) Hence find

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

writing each term in simplest form.

(5)

5. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

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

Given that

- $f'(x) = \frac{12}{\sqrt{x}} + \frac{x}{3} - 4$
- the point $P(9, 8)$ lies on C

(a) find, in simplest form, $f(x)$

(5)

The line l is the normal to C at P

(b) Find the coordinates of the point at which l crosses the y-axis.

(4)

3. Find

$$\int \frac{4x^5 + 3}{2x^2} \, dx$$

giving your answer in simplest form.

(5)

11. A curve C has equation $y = f(x), \quad x > 0$

Given that

- $f''(x) = 4x + \frac{1}{\sqrt{x}}$
- the point P has x coordinate 4 and lies on C
- the tangent to C at P has equation $y = 3x + 4$

(a) find an equation of the normal to C at P

(2)

(b) find $f(x)$, writing your answer in simplest form.

(6)

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8. The curve with equation $y = f(x)$ also passes through the point $P(4, 12)$

Given that

$$f'(x) = \frac{1}{4}x^3 - 8x^{-\frac{1}{2}}$$

(b) find $f(x)$ giving the coefficients in simplest form.

(5)

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

Given that

- $f'(x) = \dfrac{4x^2 + 10 - 7x^{\frac{1}{2}}}{4x^{\frac{1}{2}}}$
- the point $P(4, -1)$ lies on C

(a) (i) find the value of the gradient of C at P

(ii) Hence find the equation of the normal to C at P, giving your answer in the form $ax + by + c = 0$ where a, b and c are integers to be found.

(4)

(b) Find $f(x)$.

(6)

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1. Find

$$\int (2x - 5)(3x + 2)(2x + 5)\mathrm{d}x$$

writing your answer in simplest form.

(5)

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

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

Given that

- the point $P\left(2, 8\sqrt{2}\right)$ lies on C
- $f'(x) = 4\sqrt{x^3} + \frac{k}{x^2}$ where k is a constant
- $f''(x) = 0$ at P

(a) find the exact value of k,

(4)

(b) find $f(x)$, giving your answer in simplest form.

(4)

1. Find

$$\int \left(10x^4 - \frac{3}{2x^3} - 7\right) \mathrm{d}x$$

giving each term in simplest form.

(3)

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

Given that

- $f'(x) = 6x - \dfrac{(2x - 1)(3x + 2)}{2\sqrt{x}}$
- the point $P(4, 12)$ lies on C

(a) find the equation of the normal to C at P, giving your answer in the form $y = mx + c$ where m and c are integers to be found,

(4)

(b) find $f(x)$, giving each term in simplest form.

(6)

1. Find

$$\int \left(\frac{1}{2}x^3 + \frac{3}{\sqrt{x}} - 4 \right) \mathrm{d}x$$

writing your answer in simplest form.

(4)

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8. A curve C with equation $y = f(x)$ passes through the point $R(4, 13)$.

Given that

$$f'(x) = 2(x - 3)(3x + 2)$$

(a) use integration to find $f(x)$, giving your answer in simplest form.

(5)

(b) Given that $f(x)$ can be written in the form

$$(x - 3)^2(px + q)$$

find the value of the constant p and the value of the constant q.

(2)

(c) Sketch the graph of $y = f(2x)$, showing the coordinates of any points where the curve touches or crosses the coordinate axes.

(4)

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

$$f(x) = \frac{(x+5)^2}{\sqrt{x}} \qquad x > 0$$

(a) Find $\int f(x)\,dx$

(4)

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8. A curve C has equation $y = f(x)$.

The point P with x coordinate 3 lies on C

Given

- $f'(x) = 4x^2 + kx + 3$ where k is a constant
- the normal to C at P has equation $y = -\frac{1}{24}x + 5$

(a) show that $k = -5$

(3)

(b) Hence find $f(x)$.

(4)

1. Find

$$\int \left(8x^3 - 6\sqrt{x} - \frac{2}{5x^3} \right) \mathrm{d}x$$

giving your answer in simplest form.

(4)

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6. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

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

Given that

- the point $P(4, -5)$ lies on C
- $f'(x) = \dfrac{2x^2 + ax + b}{4\sqrt{x}}$, where a and b are constants
- the gradient of the tangent to C at P is 7

(a) show that

$$4a + b = 24$$

(2)

Given also that $a + b = -9$

(b) find, in simplest form, $f(x)$

(7)

Curve C is transformed to the curve with equation $y = f(x - 3)$

Given that point P is transformed to the point Q,

(c) state the coordinates of Q.

(1)