**5.** $$y = \frac{1}{2}x^4 - 3 + \frac{10}{x^2} \qquad x \neq 0$$

(a) Find $\int y \, dx$ writing the answer in simplest form.

**(3)**

(b) (i) Find $\frac{dy}{dx}$ writing the answer in simplest form.

**(3)**

(ii) Hence find the exact solutions of the equation $\frac{dy}{dx} = 3$

(*Solutions relying on calculator technology are not acceptable.*)

**(4)**

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**(4)**

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**1.** Find

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

giving each term in simplest form.

**(4)**

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

**Solutions relying on calculator technology are not acceptable.**

The curve $C$ has equation

$$y = \frac{2}{3}x^3 - 25x - \frac{56}{x} + \frac{194}{3} \qquad x > 0$$

The point $P$, which lies on $C$, has coordinates $(2, -8)$

(a) Show that an equation of the tangent to $C$ at $P$ is

$$y = -3x - 2$$

**(5)**

The point $Q$ also lies on $C$.

Given that the tangent to $C$ at $Q$ is parallel to the tangent to $C$ at $P$,

(b) find, using algebra and showing your working, the exact $x$ coordinate of $Q$.

**(5)**

**9.** (i) Find

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

giving your answer in simplest form.

**(5)**

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

Given

- $f'(x) = x^2 + ax + b$ 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, $f(x)$.

**(6)**

**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)**

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**3.**

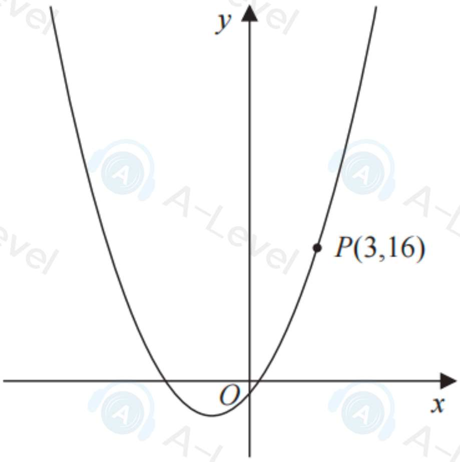


**Figure 1**

Figure 1 shows part of the curve with equation $y = x^2 + 3x - 2$

The point $P(3,16)$ lies on the curve.

(a) Find the gradient of the tangent to the curve at $P$.

**(2)**

The point $Q$ with $x$ coordinate $3 + h$ also lies on the curve.

(b) Find, in terms of $h$, the gradient of the line $PQ$. Write your answer in simplest form.

**(3)**

(c) Explain briefly the relationship between the answer to (b) and the answer to (a).

**(1)**

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

The curve $C$ has equation $y = \mathrm{f}(x)$, $x > 0$

Given that

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

(a) find the exact value of $k$,

**(4)**

(b) find $\mathrm{f}(x)$, 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)**

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8. The curve $C$ has equation

$$y = (x - 2)(x - 4)^2$$

(a) Show that

$$\frac{dy}{dx} = 3x^2 - 20x + 32$$

**(4)**

The line $l_1$ is the tangent to $C$ at the point where $x = 6$

(b) Find the equation of $l_1$, giving your answer in the form $y = mx + c$, where $m$ and $c$ are constants to be found.

**(4)**

The line $l_2$ is the tangent to $C$ at the point where $x = \alpha$

Given that $l_1$ and $l_2$ are parallel and distinct,

(c) find the value of $\alpha$

**(3)**

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

**Solutions relying on calculator technology are not acceptable.**

A curve has equation

$$y = \frac{4x^2 + 9}{2\sqrt{x}} \qquad x > 0$$

Find the $x$ coordinate of the point on the curve at which $\frac{dy}{dx} = 0$

**(6)**

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