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APPLICATIONS OF INTEGRATION

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QUESTION 1

Evaluate the following

(a) $\int_1^6 3x - 1 \, dx$

(b) $\int_2^4 \frac{3}{x^4} + 1 \, dx$

(c) $\int_1^6 \sqrt{x+3} \, dx$

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QUESTION 2

Given that $\int_{-2}^5 f(x) \, dx = 14$, find

(a) $\int_{-2}^5 3f(x) \, dx$

(b) $\int_5^{-2} [f(x) - 3x] \, dx$

QUESTION 3

Differentiate $x \cos 3x$ with respect to x . Hence, show that $\int_0^{\frac{\pi}{9}} x \sin 3x \, dx = \frac{\sqrt{3}}{18} - \frac{\pi}{54}$.

QUESTION 4

A curve passes through the point $\left(-2, \frac{1}{2}\right)$ and has gradient given by $\frac{dy}{dx} = (2x+1)^2$. Find the equation of the curve.

QUESTION 5

At any point (x, y) on a curve, $\frac{d^2y}{dx^2} = \frac{18}{(x-2)^3}$. The gradient of the curve at $(5, 20)$ is 2.Find the equation of the tangent to the curve when it cuts the y -axis.

QUESTION 6

The curve for which $\frac{dy}{dx} = \frac{a}{(2x+3)^3} - 1$, where a is a constant, is such that the tangent to the curve at $(-1, 0)$ is perpendicular to the line $5y = x + 1$. Find the value of a and the equation of the curve.

QUESTION 7

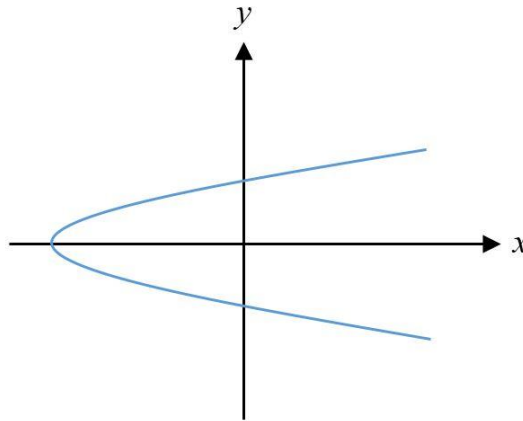
Express $\frac{4-5x}{2+x-x^2}$ in partial fractions. Hence, integrate $\int_0^1 \frac{4-5x}{2+x-x^2} dx$.

QUESTION 8

Find the total area enclosed by the curve $y = (3x-2)(x+2)$ and the x -axis.

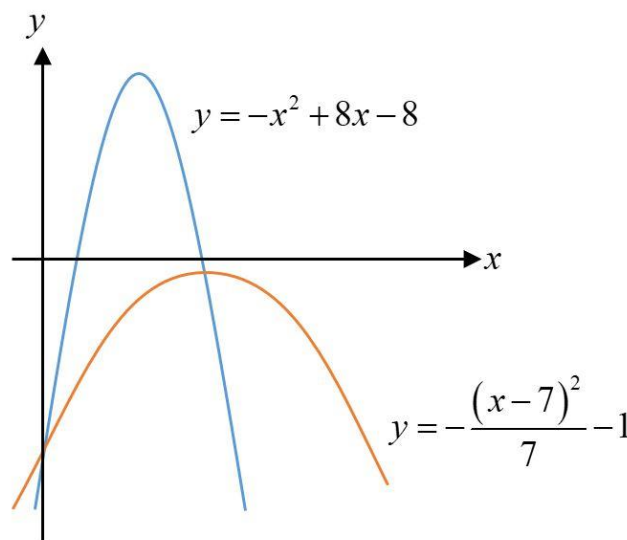
QUESTION 9

The figure shows the curve $x = y^2 - 9$. Find the area of the region bounded by the curve, y -axis and the line $y = 4$.



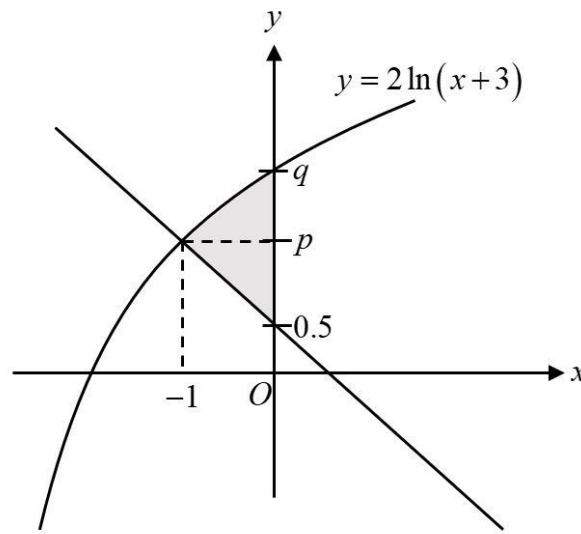
QUESTION 10

The figure shows the two curves $y = -x^2 + 8x - 8$ and $y = -\frac{(x-7)^2}{7} - 1$. Find the area of the region bounded by the curves.



QUESTION 11

In the diagram, the curve $y = 2\ln(x+3)$ cuts the y -axis at $(0, q)$. A line, which meets the curve at $(-1, p)$ cuts the y -axis at $(0, 0.5)$.



- (a) State the exact value of p and of q .
- (b) Calculate the exact area of the shaded region.