



Differentiation: Products 3ii

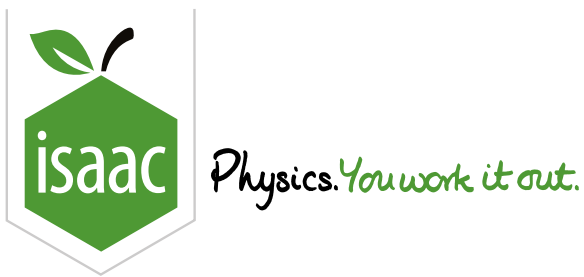


Find the exact value of the x -coordinate of the stationary point of the curve $y = x \ln x$.

The following symbols may be useful: e , x

Used with permission from UCLES A-level Maths papers, 2003-2017.

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



[Home](#) [Gameboard](#) Maths Differentiation: Quotients 3ii

Differentiation: Quotients 3ii

A Level



Part A Differentiate

A curve has equation $y = \frac{2x+1}{3x-1}$. Find an expression for $\frac{dy}{dx}$ in terms of x .

The following symbols may be useful: $\text{Derivative}(y, x)$, $\ln()$, $\log()$, x , y

Part B Tangent

Hence find the equation of the tangent to this curve at the point $(1, \frac{3}{2})$, giving your answer in the form $ax + by + c = 0$, where a , b , and c are integers.

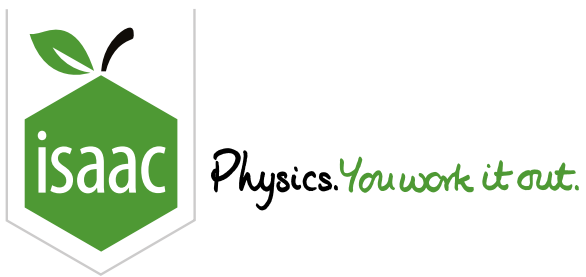
The following symbols may be useful: x , y

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

STEM SMART Single Maths 47 - Calculus Revision

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



[Home](#) [Gameboard](#) [Maths](#) [Integration by Substitution 1ii](#)

Integration by Substitution 1ii

A Level



Use the substitution $x = \frac{1}{3} \sin \theta$ to find the exact value of

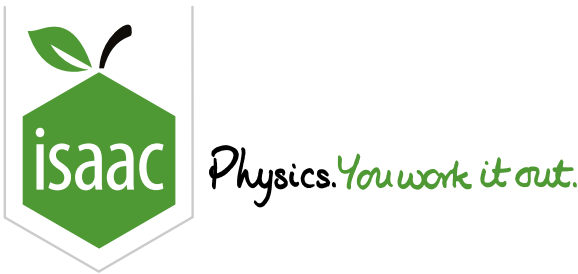
$$\int_0^{\frac{1}{6}} \frac{1}{(1 - 9x^2)^{\frac{3}{2}}} dx$$

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

STEM SMART Single Maths 47 - Calculus Revision

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



Area Between Two Curves 1ii

A Level
P P P

Figure 1 shows the curve $y = e^{3x} - 6e^{2x} + 32$.

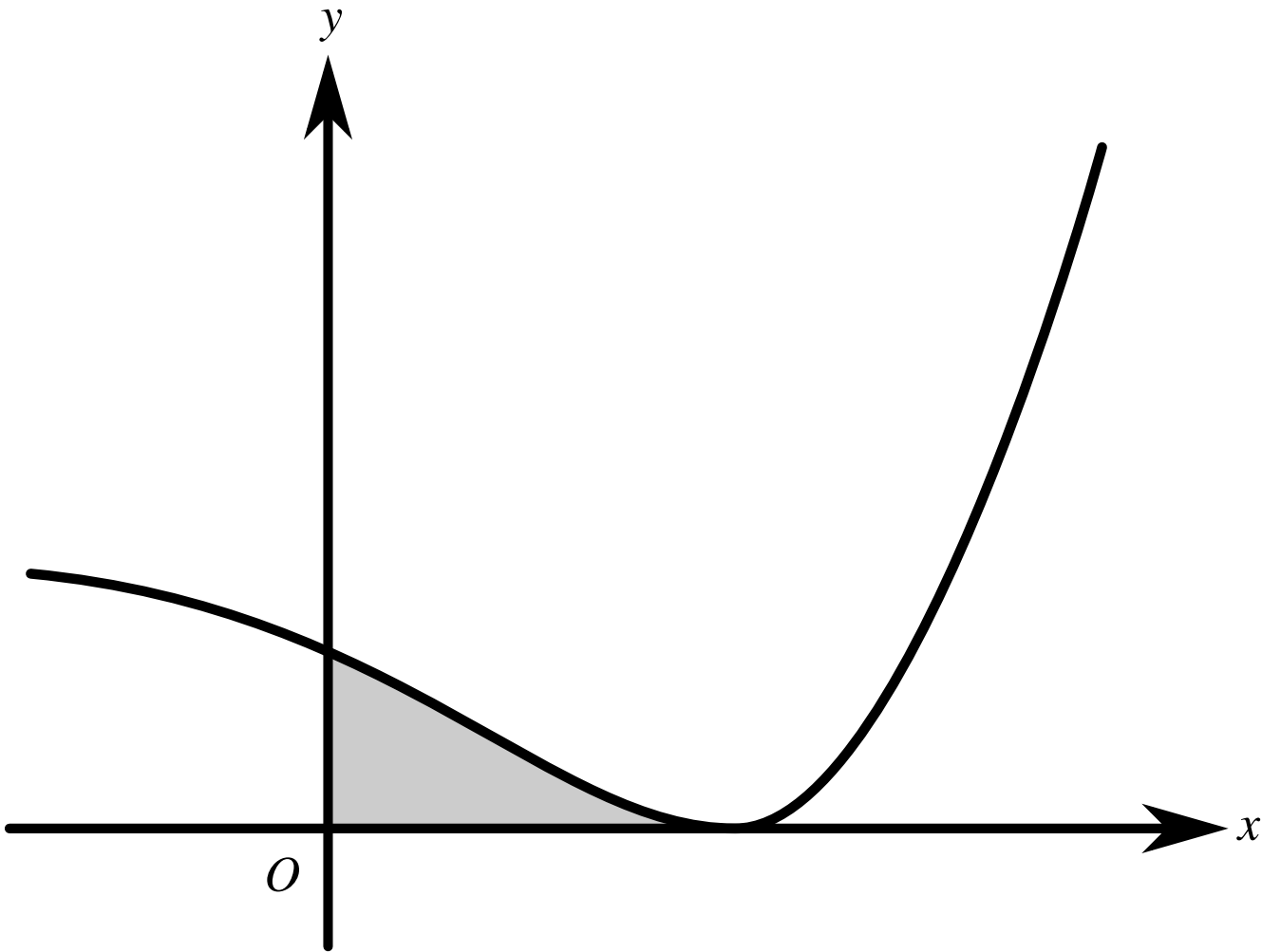


Figure 1: The curve $y = e^{3x} - 6e^{2x} + 32$.

Part A **x -coordinate**

Give the exact x -coordinate of the minimum point and verify that the y -coordinate of the minimum point is 0.

The following symbols may be useful: x

Part B Area of shaded region

Find the exact area of the shaded region enclosed by the curve and the coordinate axes.

The following symbols may be useful: $\ln()$, $\log()$

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

STEM SMART Single Maths 47 - Calculus Revision

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



Physics. *You work it out.*

[Home](#) [Gameboard](#) [Maths](#) [Differentiation: Chain Rule 4i](#)

Differentiation: Chain Rule 4i

A Level



Earth is being added to a pile so that, when the height of the pile is h metres, its volume is V cubic metres, where

$$V = (h^6 + 16)^{\frac{1}{2}} - 4.$$

Part A Rate of change of volume

Find the value of $\frac{dV}{dh}$ when $h = 2$, to three significant figures.

Part B Rate of change of height

The volume of the pile is increasing at a constant rate of 8 cubic metres per hour. Find the rate in metres per hour, at which the height of the pile is increasing at the instant when $h = 2$. Give your answer correct to 2 significant figures.

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

[**STEM SMART Single Maths 47 - Calculus Revision**](#)

All materials on this site are licensed under the [**Creative Commons license**](#), unless stated otherwise.

Physics. *You work it out.*[Home](#) [Gameboard](#) [Maths](#) [Modelling - Advanced 2ii](#)

Modelling - Advanced 2ii

A Level



At time t seconds, the radius of a spherical balloon is r cm. The balloon is being inflated so that the rate of increase of its radius is inversely proportional to the square root of its radius. When $t = 5$, $r = 9$ and, at this instant, the radius is increasing at 1.08 cm s^{-1} .

Part A Differential equation

Write down a differential equation to model this situation. Your answer should include a constant k , whose value you do not need to determine yet.

The following symbols may be useful: $\text{Derivative}(r, t)$, k , r , t

Part B Solution

Solve the differential equation to express r in terms of t . Your answer should include some numerical constants, which should be converted to exact fractions.

The following symbols may be useful: r , t

Part C Initial condition

How much air (in cm^3) is in the balloon initially? Write your answer as an exact expression.

The following symbols may be useful: π

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

STEM SMART Single Maths 47 - Calculus Revision

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



Physics. *You work it out.*

[Home](#) [Gameboard](#) Maths Differentiation: Implicit 4i

Differentiation: Implicit 4i

A Level
P P P

Find the equation of the normal to the curve $x^3 + 2x^2y = y^3 + 15$ at the point $(2, 1)$, giving your answer in the form $ax + by + c = 0$, where a , b and c are integers.

The following symbols may be useful: x , y

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

STEM SMART Single Maths 47 - Calculus Revision

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



Physics. *You work it out.*

[Home](#) [Gameboard](#) [Maths](#) [Parametric Equations 4ii](#)

Parametric Equations 4ii

A Level
P P P

A curve has parametric equations $x = \frac{1}{t} - 1$ and $y = 2t + \frac{1}{t^2}$

Part A Gradient function

Find $\frac{dy}{dx}$ in terms of t , simplifying your answer.

The following symbols may be useful: $\text{Derivative}(y, x)$, t , x , y

Part B Stationary point

Find the (x, y) coordinates of the stationary point.

If a value is not a whole number, enter the value as a decimal.

(,)

By considering the gradient of the curve on either side of this point, determine its nature.

- ☐ Point of inflection
- ☐ Minimum
- ☐ Maximum

Part C Cartesian equation

Find the cartesian equation of the curve.

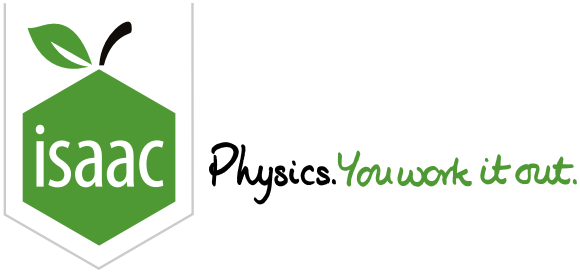
The following symbols may be useful: x , y

Used with permission from UCLES A-level Maths papers, 2003-2017.

Gameboard:

STEM SMART Single Maths 47 - Calculus Revision

All materials on this site are licensed under the **Creative Commons license**, unless stated otherwise.



Integration by Parts 3i



Find $\int_0^\pi (x^2 + 5x + 7) \sin x \, dx$.

The following symbols may be useful: π

Used with permission from UCLES A-level Maths papers, 2003-2017.

All materials on this site are licensed under the [Creative Commons license](#), unless stated otherwise.