



Physics. *You work it out.*

[Home](#) [Gameboard](#) [Maths](#) [Area Between Two Curves 1ii](#)

Area Between Two Curves 1ii

A Level



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

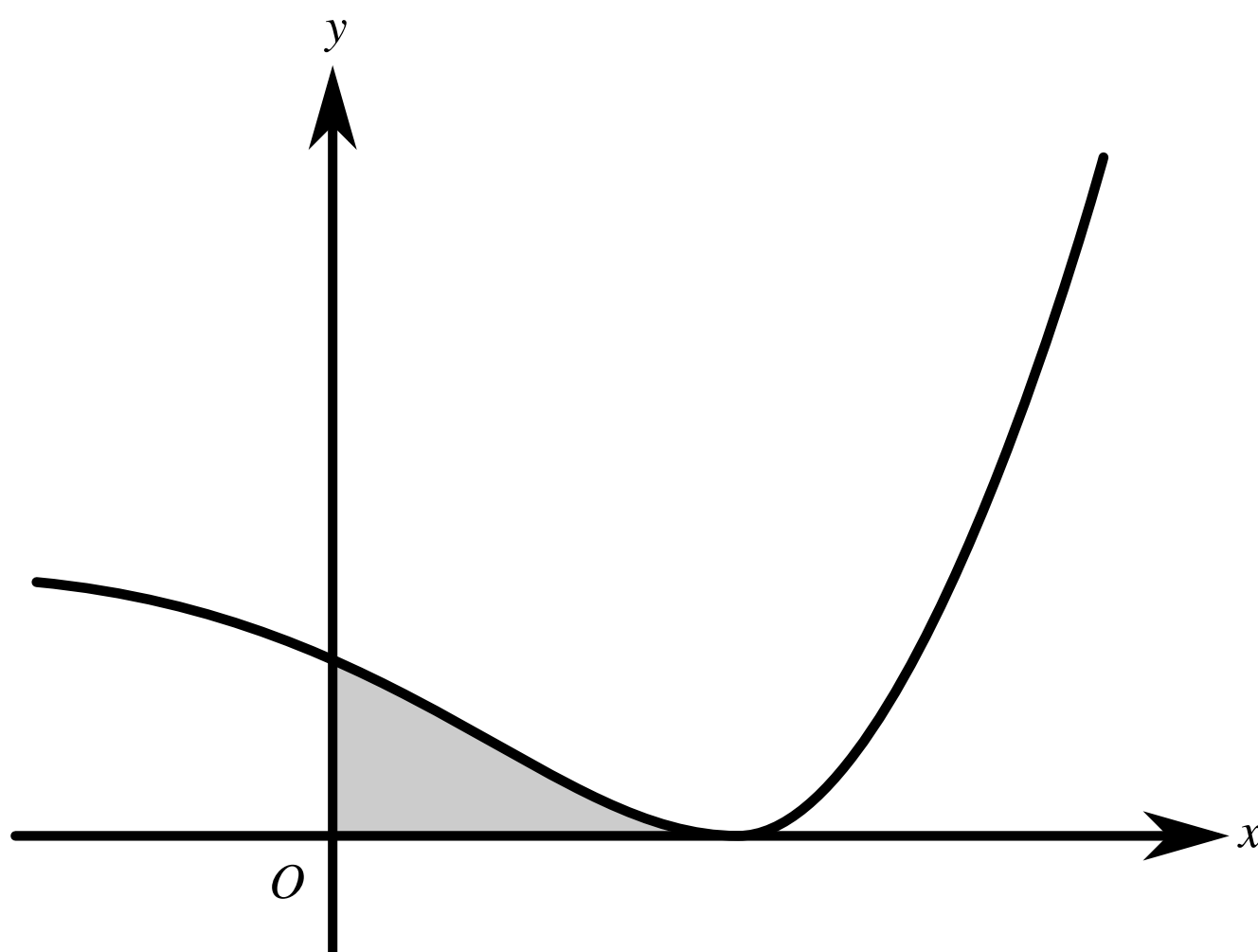


Figure 1: The curve $y = e^{3x} - 6e^{2x} + 32$.

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: \times

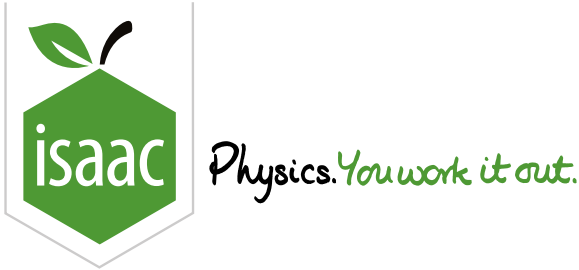
Part B Area of shaded region

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

The following symbols may be useful: e

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

All materials on this site are licensed under the [Creative Commons license](https://creativecommons.org/licenses/by/4.0/), unless stated otherwise.



Integration - Trig Manipulations 4i



Find the exact value of $\int_0^{\frac{\pi}{6}} (1 - \sin 3x)^2 dx$.

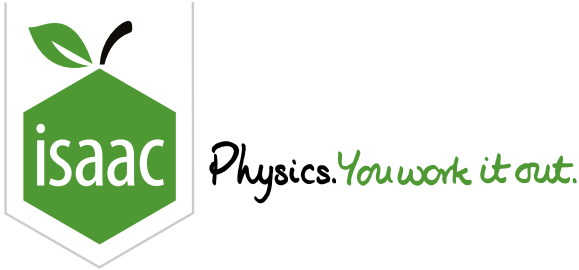
The following symbols may be useful: π i

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

Gameboard:

STEM SMART Single Maths 47 - Integration Revision

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



Integration by Substitution 1ii



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

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

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

Gameboard:

STEM SMART Single Maths 47 - Integration Revision

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



Physics. *You work it out.*

Integration by Substitution 3i

A Level

P

P

P

Part A

Substitution

Find the expression that appears to the right of the integral sign after the substitution $u = e^x + 1$ has been applied to $\int \frac{e^{2x}}{e^x + 1} dx$. Include du in your answer.

The following symbols may be useful: du , u

Part B

Integral

Hence find the exact value of $\int_0^1 \frac{e^{2x}}{e^x + 1} dx$.

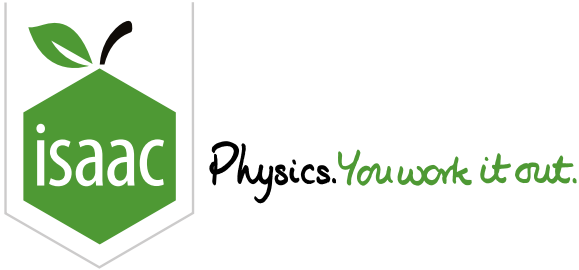
The following symbols may be useful: e

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

Gameboard:

STEM SMART Single Maths 47 - Integration Revision

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



Integration by Parts 4ii

A Level

P

P

P

Find $\int_0^1 16xe^{4x} \, dx$, in an exact form.

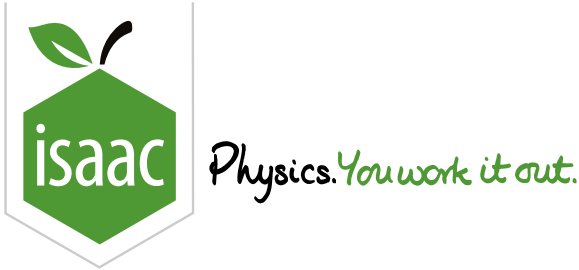
The following symbols may be useful: e

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

Gameboard:

STEM SMART Single Maths 47 - Integration 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.

Gameboard:

STEM SMART Single Maths 47 - Integration Revision

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



Physics. *You work it out.*

Algebraic Division 1i

A Level

P

P

P

Part A Algebraic Division

Use algebraic division to express $\frac{x^3-2x^2-4x+13}{x^2-x-6}$ in the form $Ax + B + \frac{Cx+D}{x^2-x-6}$, where A , B , C , and D are constants.

The following symbols may be useful: x

Part B Partial Fractions

Express the term of the form $\frac{Cx+D}{x^2-x-6}$ from the above part in partial fractions.

The following symbols may be useful: x

Part C Integral

Hence find $\int_4^6 \frac{x^3 - 2x^2 - 4x + 13}{x^2 - x - 6} dx$, giving your answer in the form $a + \ln b$.

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

Gameboard:

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



Physics. *You work it out.*

[Home](#) [Gameboard](#) [Maths](#) [Integration of Differential Equations 3i](#)

Integration of Differential Equations 3i

A Level



Part A Partial Fractions

Express

$$\frac{16 + 5x - 2x^2}{(x + 1)^2(x + 4)}$$

in partial fractions.

The following symbols may be useful: x

Part B Specific Solution

It is given that

$$\frac{dy}{dx} = \frac{(16 + 5x - 2x^2)y}{(x + 1)^2(x + 4)}$$

and that $y = \frac{1}{256}$ when $x = 0$. Use this condition to find an expression for $\ln(y)$.

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

Part C Exact Value of y

Find the exact value of y when $x = 2$. Give your answer in the form Ae^2 .

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

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

Gameboard:

STEM SMART Single Maths 47 - Integration 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.

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