Integration by Substitution 1

A Level Further A

Part A Integrate $\sin(c\theta)$

Find $\int \sin(c\theta)\mathrm{d}\theta$, where c is a constant.

The following symbols may be useful: `c, k, theta`

Part B Integrate $e^{\alpha v}$

Find $\int \mathrm{e}^{\alpha v}\mathrm{d}v$, where α is a constant.

The following symbols may be useful: `alpha, e, k, v`

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Integration by Substitution 2

A Level Further A

Part A Integrate $(bv + c)^2$

Find $\int (bv + c)^2 \mathrm{d}v$, where b and c are constants.

The following symbols may be useful: `b, c, k, v`

Part B Integrate $a(y - b)^3$

Find $\int_0^b a(y - b)^3 \mathrm{d}y$, where a and b are constants.

The following symbols may be useful: `a, b`

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Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration: General 4ii

A Level

Part A Integrate $(4-3x)^7$

Find $\int (4-3x)^7 \mathrm{d}x$.

The following symbols may be useful: `c, x`

Part B Integrate $(4-3x)^{-1}$

Find $\int (4-3x)^{-1} \mathrm{d}x$.

The following symbols may be useful: `c, x`

Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration by Substitution 5ii

A Level

Use the substitution $u = 2x - 5$ to find the exact value of $\int_{\frac{5}{2}}^{3} (4x - 8)(2x - 5)^7 \mathrm{d}x$.

Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration by Substitution 5i

A Level

Use the substitution $u = 2x + 1$ to evaluate $\int_0^{\frac{1}{2}} \frac{4x - 1}{(2x + 1)^5} \mathrm{d}x$.

Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration by Substitution 4ii

A Level

Use the substitution $u = \sqrt{x+2}$ to find the exact value of $\int_{-1}^{7} \frac{x^2}{\sqrt{x+2}} \mathrm{d}x$.

Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration by Substitution 4i

A Level

Use the substitution $u = 1 + \sqrt{x}$ to find the exact value of $\int_4^9 \frac{1}{1+\sqrt{x}} \mathrm{d}x$ in the form $a + b\ln(c)$, where a, b, and c are positive constants to be found.

Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration by Substitution 3

A Level

Part A Integrate $\frac{3}{(z+1)^2}$

Find $\int_0^2 \frac{3}{(z+1)^2}\mathrm{d}z$.

Part B Integrate $\frac{e^{-\alpha x}}{(1+e^{-\alpha x})^4}$

Find $\int \frac{\mathrm{e}^{-\alpha x}}{(1+\mathrm{e}^{-\alpha x})^4}\mathrm{d}x$, where α is a constant.

The following symbols may be useful: `alpha, e, k, x`

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Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration by Substitution 2i

A Level

In this question, I denotes the definite integral $\int_2^5 \frac{5-x}{2+\sqrt{x-1}}\mathrm{d}x$. The value of I can be found using two different methods.

Part A Substitution

Show that the substitution $u = \sqrt{x-1}$ transforms I to $\int_1^2 (4u - 2u^2)\mathrm{d}u$ and hence find the exact value of I.

The following symbols may be useful: `I`

Part B Rationalisation

Simplify as far as possible $\left(2+\sqrt{x-1}\right)\left(2-\sqrt{x-1}\right)$.

The following symbols may be useful: `x`

By first multiplying the numerator and denominator of $\frac{5-x}{2+\sqrt{x-1}}$ by $2-\sqrt{x-1}$, find the exact value of I.

The following symbols may be useful: `I`

Gameboard:

STEM SMART Single Maths 31 - Integration by Substitution

Integration: General 5i

A Level

Part A Integrate $\frac{18}{\sqrt{6x+1}}$

Find $\int_0^4 \frac{18}{\sqrt{6x+1}}\,\mathrm{d}x$ correct to two significant figures.

Part B Integrate $(\mathrm{e}^x+2)^2$

Find $\int_0^1 (\mathrm{e}^x+2)^2\,\mathrm{d}x$, giving your answer in terms of e.

The following symbols may be useful: e