

Five common P1 integration mistakes

Pearson Edexcel International A Level Mathematics

Use this free ExamLantern worksheet to check indefinite integration with powers and find a curve from a point. Review the five fixes, attempt the questions, then check the worked answers.

Power rule $\int x^n dx = x^{n+1}/(n+1) + C, n \neq -1$

Work where the expression is defined. Check by differentiating.

1 Forgetting the constant of integration

Common error $\int 12x^2 dx = 4x^3$

Correction $\int 12x^2 dx = 4x^3 + C$

Different constants give the same derivative. Include + C when giving the general indefinite integral.

2 Dividing by the old power

Common error $\int 6x^5 dx = (6/5)x^6 + C$

Correction $\int 6x^5 dx = x^6 + C$

Increase the power from 5 to 6, then divide by 6. Differentiating x to the power 6 gives $6x$ to the power 5.

3 Leaving a constant term unchanged

Common error $\int (4x + 7) dx = 2x^2 + 7 + C$

Correction $\int (4x + 7) dx = 2x^2 + 7x + C$

The derivative of $7x$ is 7. A constant term in the integrand becomes a multiple of x ; this is separate from + C.

4 Losing the sign with a negative power

Common error $\int 5/x^2 dx = 5/x + C$

Correction $\int 5/x^2 dx = -5/x + C$

Rewrite $5/x^2$ as $5x$ to the power -2. The new power is -1, so divide by -1. This expression requires x not equal to zero.

5 Using the point in the derivative

Common error For $dy/dx = 8x - 3$ through $(2, 14)$, use $14 = 8(2) - 3$.

Correction $y = 4x^2 - 3x + C$; $14 = 16 - 6 + C$; $C = 4$.

The point gives x and y , not the gradient. Integrate first, then substitute into y . The curve is $y = 4x^2 - 3x + 4$.

Try five integration questions

Show your method. Include the constant of integration where needed. For questions involving fractions or roots, use an interval where the integrand is defined.

A Find $\int (9x^2 - 4x + 6) dx$.

B Find $\int 14x^6 dx$.

C Find $\int [(6x^3 - 5x^2 + 12)/x^2] dx$, for $x \neq 0$.

D Find $\int (3\sqrt{x} + 2/\sqrt{x}) dx$, for $x > 0$.

E A curve has $dy/dx = 10x - 4$ and passes through (3, 29). Find its equation.

Before checking your answers

- Did I increase the power and divide by the new power?
- Did I integrate constant terms and include + C?
- Did I rewrite fractions and roots carefully?
- Did I substitute the point after integrating?
- Does differentiating my answer recover the integrand or derivative?

Worked answers

Compare your method as well as your final expression.

A $3x^3 - 2x^2 + 6x + C$

Integrate each term separately: $9x^3/3 - 4x^2/2 + 6x + C$.

Simplify: $3x^3 - 2x^2 + 6x + C$.

Check: its derivative is $9x^2 - 4x + 6$.

B $2x^7 + C$

Increase the power to 7 and divide by 7: $14x^7/7 + C$.

Simplify: $2x^7 + C$. Its derivative is $14x^6$.

C $3x^2 - 5x - 12/x + C$, on an interval not containing 0

Divide every term by x^2 : $6x - 5 + 12x^{-2}$.

Integrate: $3x^2 - 5x - 12x^{-1} + C$.

So the answer is $3x^2 - 5x - 12/x + C$. Differentiate to get $6x - 5 + 12/x^2$.

D $2x^{3/2} + 4x^{1/2} + C$, for $x > 0$

Rewrite the integrand as $3x^{1/2} + 2x^{-1/2}$.

Integrate: $[3/(3/2)]x^{3/2} + [2/(1/2)]x^{1/2} + C$.

Simplify: $2x^{3/2} + 4x^{1/2} + C$. Differentiation recovers the original integrand.

E $y = 5x^2 - 4x - 4$

Integrate: $y = 5x^2 - 4x + C$.

Substitute the point: $29 = 45 - 12 + C$, so $C = -4$.

Hence $y = 5x^2 - 4x - 4$. At $x = 3$, $y = 29$; differentiating gives $10x - 4$.

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