# Test - Integration techniques and differential equations

Year: Year 13 · Duration: 40 minutes · /20

| Name: | Date: | **Mark: /20** |
|---|---|---|

| Question | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|
| marks | 4 | 4 | 4 | 4 | 4 | **20** |
| Mark | | | | | | |

Show your working.

## Question 1 (4 marks)

**Question 1 – Standard integrals**

Evaluate $\int_0^1 \left(e^{2x} + \frac{1}{2x+1}\right) dx$, giving an exact answer.

## Question 2 (4 marks)

**Question 2 – Substitution**

Use the substitution $u = x^2 + 3$ to evaluate $\int_0^1 2x\sqrt{x^2+3}\,dx$.

## Question 3 (4 marks)

**Question 3 – By parts**

Find the exact value of $\int_1^e x^2 \ln x\,dx$.

## Question 4 (4 marks)

**Question 4 – Partial fractions**

Express $\frac{3x+5}{(x+1)(x+2)}$ in partial fractions and evaluate $\int_2^3 \frac{3x+5}{(x+1)(x+2)}dx$ in the form $\ln k$.

## Question 5 (4 marks)

**Question 5 – A differential equation**

Solve $\frac{dy}{dx} = 2xy^2$ given that $y = 1$ when $x = 0$, giving $y$ in terms of $x$, and state the

values of $x$ for which the solution is valid.