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**2014 11d****3**

Evaluate  $\int_2^5 \frac{x}{\sqrt{x-1}} dx$  using the substitution  $x = u^2 + 1$ .

$$x = u^2 + 1$$

$$\text{Also, } u^2 = x - 1$$

$$\frac{dx}{du} = 2u$$

$$u = \sqrt{x-1}$$

$$dx = 2u du$$

If  $x = 5$ , then  $u = 2$ , if  $x = 2$ , then  $u = 1$ .

$$\begin{aligned} \int_2^5 \frac{x}{\sqrt{x-1}} dx &= \int_1^2 \frac{u^2 + 1}{u} 2u du \\ &= 2 \int_1^2 (u^2 + 1) du \\ &= 2 \left[ \frac{u^3}{3} + u \right]_1^2 \\ &= 2 \left[ \frac{2^3}{3} + 2 - \left( \frac{1^3}{3} + 1 \right) \right] \\ &= \frac{20}{3} \end{aligned}$$

State Mean: <b>1.81</b>
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\* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by BOSTES.

### Board of Studies: Notes from the Marking Centre

Most candidates found the derivative for the given substitution of  $u = x^2 + 1$  and/or changed the limits correctly.

A common problem was:

- making errors when trying to re-arrange the integrand, sometimes leading to an expression which contained both  $x$  and  $u$ , making it difficult to go further

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