Calculus 1 Unit 8 worksheet: u-substitution

Name _____ Date _____ Period _____

1. Find each indefinite integral by a substitution. Name u and du, and check each answer by differentiating.

(a) $\displaystyle\int \frac{8}{(2x+5)^3}\,dx$

(b) $\displaystyle\int x^4 e^{x^5}\,dx$

(c) $\displaystyle\int \sec^2 x \tan^3 x\,dx$

(d) $\displaystyle\int \frac{dx}{x \ln x}$

2. Find $\displaystyle\int 3x\left(9-x^2\right)^5\,dx$. Check your answer by differentiating.

3. In each integral the natural choice of u leaves a stray factor of x. Solve the substitution for x, rewrite the whole integrand in u, and find the integral.

(a) $\displaystyle\int (x+1)\sqrt{2x-1}\,dx$

(b) $\displaystyle\int x^2\sqrt{x+2}\,dx$

4. Evaluate each integral by a substitution, changing the limits of integration to u-values.

(a) $\displaystyle\int_0^{\sqrt{\pi}} x\sin\left(x^2\right)\,dx$

(b) $\displaystyle\int_1^e \frac{\sqrt{1+3\ln x}}{x}\,dx$

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5. Ava runs an online chess club. When she opens a new season of tournaments, the club already has 1,500 members, and new members join at the rate

$$r(t) = \frac{400t}{t^2 + 9}$$

members per week, where t is the number of weeks since the season opened. Nobody leaves the club during the season.

(a) Find the exact number of members who join in the first 4 weeks, and round it to the nearest whole member.

(b) Find a formula for $M(T)$, the number of members T weeks after the season opens.

(c) After how many weeks have 400 new members joined? Give the exact value, then use a calculator and round to one decimal place.

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