Calculus AB

4-5

(Day 1)

Integration by Substitution

Find the indefinite integral. (pg. 306)

14) $\int \underbrace{\sqrt[3]{3-4x^2}}_{u}\underbrace{(-8x)\,dx}_{du}$

Let $u = 3-4x^2$

$du = -8x\,dx$

$\int \sqrt[3]{u}\,du = \int u^{\frac{1}{3}}du$

$\frac{3}{4}u^{\frac{4}{3}}+C = \frac{3}{4}(3-4x^2)^{\frac{4}{3}}+C$

20) $\int t^3\sqrt{\underbrace{t^4+5}_{u}}\,dt$

$u = t^4-5$

$du = 4t^3dt$

Need 4

Note: we need a 4 to get du, so we put a 4 in and cancel it out front with a 1/4.

$\frac{1}{4}\int 4t^3\sqrt{t^4+5}\,dt$

$\frac{1}{4}\int\sqrt{u}\,du$

$\frac{1}{4}\left[\frac{2}{3}u^{\frac{3}{2}}\right]+C$

$\frac{1}{6}\sqrt{(t^4+5)^3}+C$

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28) $\int \frac{1}{2\sqrt{x}}\,dx$

$\int \frac{1}{2}x^{-\frac{1}{2}}dx$

$x^{\frac{1}{2}}+C$

$\sqrt{x}+C$

This one doesn't have a chain rule, so we don't need a u-substitution.

36) $\int\left(\frac{t^3}{3}+\frac{1}{4t^2}\right)dt$

$\frac{1}{12}t^4-\frac{1}{4}t^{-1}+C$

$\boxed{\frac{t^4}{12}-\frac{1}{4t}+C}$

This one doesn't have a chain rule, so we don't need a u-substitution.

Solve the differential equation.

40) $\frac{dy}{dx} = \frac{10x^2}{\sqrt{1+x^3}}$

We can put the constant, 10, on the outside of the integral.

$u = 1+x^3$

$du = 3x^2dx$

$\int dy = \int\frac{10x^2}{\sqrt{\underbrace{1+x^3}_{u}}}dx$

$y = \frac{10}{3}\int\frac{3x^2}{\sqrt{1+x^3}}dx = \frac{10}{3}\int\frac{1}{\sqrt{u}}du$

$y = \frac{10}{3}\left[2u^{\frac{1}{2}}\right]+C$

$y = \frac{10}{3}\left[2\sqrt{1+x^3}\right]+C$

Assignment:

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11-41 odd