Do Now: From last night's homework sheet #s 16 and 17

16. $\int (1-x^2)^5 x\,dx$

$u = 1-x^2$

$du = -2x\,dx$

$\frac{du}{-2} = x\,dx$

$-\frac{1}{2}\int u^5\,du$

$-\frac{1}{2}\cdot\frac{u^6}{6} + C$

$-\frac{(1-x^2)^6}{12} + C$

17. $\int \frac{x\,dx}{(x^2+1)^3}$

$u = x^2+1$

$du = 2x\,dx$

$\frac{du}{2} = x\,dx$

$\frac{1}{2}\int u^{-3}\,du$

$\frac{1}{2}\cdot\frac{u^{-2}}{-2} + C$

$-\frac{1}{4(x^2+1)^2} + C$

Classwork: Continuing in last night's hw sheet…

18. $\int \sqrt[3]{1+x^2}\,x\,dx$

$u = 1+x^2$

$du = 2x\,dx$

$\frac{du}{2} = x\,dx$

$\frac{1}{2}\int u^{\frac{1}{3}}\,du$

$\frac{1}{2}\cdot\frac{3}{4}u^{\frac{4}{3}} + C$

$\frac{3}{8}(1+x^2)^{\frac{4}{3}} + C$

19. $\int \frac{\sin\theta}{\cos^2\theta}\,d\theta$

$u = \cos\theta$

$du = -\sin\theta\,d\theta$

$-du = \sin\theta\,d\theta$

$-\int u^{-2}\,du$

$-\left(\frac{u^{-1}}{-1}\right) + C$

$\frac{1}{\cos\theta} + C$

$\sec\theta + C$

$\int \frac{\sin\theta}{\cos\theta}\cdot\frac{1}{\cos\theta}\,d\theta$

$\int \tan\theta\sec\theta\,d\theta$

$\sec\theta + C$

20. $\int \frac{e^{\sqrt{t}}}{\sqrt{t}}\,dt = \int e^{\sqrt{t}}\cdot\frac{1}{\sqrt{t}}\,dt$

$u = \sqrt{t} = t^{\frac{1}{2}}$

$du = \frac{1}{2}t^{-\frac{1}{2}}\,dt = \frac{1}{2\sqrt{t}}\,dt$

$2\,du = \frac{1}{\sqrt{t}}\,dt$

$2\int e^u\,du$

$2e^u + C$

$2e^{\sqrt{t}} + C$

21. $\int \sin 3\theta\,d\theta$

$-\frac{1}{3}\cos 3\theta + C$

$u = 3\theta$

$du = 3\,d\theta$

$\frac{du}{3} = d\theta$

$\frac{1}{3}\int \sin u\,du$

$-\frac{1}{3}\cos u + C$

$-\frac{1}{3}\cos 3\theta + C$

22. $\int e^x \sin e^x \, dx$

$u = e^x$
$du = e^x dx$

$\int \sin u \, du$

$-\cos u + C$
$-\cos e^x + C$

23. $\int \frac{dx}{\sqrt{2x+5}}$

$u = 2x+5$
$du = 2dx$
$\frac{du}{2} = dx$

$\frac{1}{2} \int u^{-\frac{1}{2}} du$

$\frac{1}{\cancel{2}} \cdot \cancel{2} u^{\frac{1}{2}} + C$

$\sqrt{2x+5} + C$

24. $\int (x-3)^{5/2} \, dx$

$u = x-3$
$du = dx$ * when $du = dx$, you can just use the power

$\int u^{5/2} du$

$\frac{2}{7} u^{7/2} + C$

$\frac{2}{7} (x-3)^{7/2} + C$

25. $\int \frac{dx}{(4x+3)^3}$

$u = 4x+3$
$du = 4dx$
$\frac{du}{4} = dx$

$\frac{1}{4} \int u^{-3} du$

$\frac{1}{4} \cdot \frac{u^{-2}}{-2} + C$

$-\frac{1}{8(4x+3)^2} + C$

Try these:

27. $\int \frac{2x+3}{(x^2+3x+5)^4} dx$

28. $\int e^{2x} \, dx$

29. $\int \frac{dx}{\sqrt{x}(1+\sqrt{x})^3}$

30. $\int x^4 \sin x^5 \, dx$

Answers to the Try these:

27) $\int \frac{2x+3}{(x^2+3x+5)^4}\,dx$

$u = x^2+3x+5$

$du = 2x+3\,dx$

$\int u^{-4}\,du$

$\frac{u^{-3}}{-3} + C$

$-\frac{1}{3(x^2+3x+5)^3} + C$

28) $\int e^{2x}\,dx$

$u = 2x$

$du = 2dx$

$du/2 = dx$

$\frac{1}{2}\int e^u\,du$

$\frac{1}{2}e^u + C$

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

29) $\int \frac{dx}{\sqrt{x}(1+\sqrt{x})^3}$

$u = 1+\sqrt{x}$

$du = \frac{1}{2\sqrt{x}}\,dx$

$2du = \frac{1}{\sqrt{x}}\,dx$

$2\int u^{-3}\,du$

$\cancel{2}\,\frac{u^{-2}}{-\cancel{2}} + C$

$-\frac{1}{u^2} + C$

$-\frac{1}{(1+\sqrt{x})^2} + C$

30) $\int x^4 \sin x^5\,dx$

$u = x^5$

$du = 5x^4\,dx$

$du/5 = x^4\,dx$

$\frac{1}{5}\int \sin u\,du$

$-\frac{1}{5}\cos u + C$

$-\frac{1}{5}\cos x^5 + C$

Homework 02-01

Integration Practice Answer Key

① $\int (1+3x)^5\, 3dx$

$u = 1+3x$

$du = 3dx$

$\int u^5\, du$

$\frac{1}{6}u^6 + C$

$\frac{1}{6}(1+3x)^6 + C$

② $\int \frac{x}{(1+x^2)^3}dx$

$u = 1+x^2$

$du = 2x\,dx$

$du/2 = x\,dx$

$\frac{1}{2}\int u^{-3}du$

$\frac{1}{2} \cdot \frac{u^{-2}}{-2} + C$

$-\frac{1}{4u^2} + C$

$-\frac{1}{4(1+x^2)^2} + C$

③ $\int e^{\sin\theta}\cos\theta\, d\theta$

$u = \sin\theta$

$du = \cos\theta\, d\theta$

$\int e^u du$

$e^u + C$

$e^{\sin\theta} + C$

④ $\int \frac{x}{\sqrt{1+x^2}}dx$

$u = 1+x^2$

$du = 2x\,dx$

$du/2 = x\,dx$

$\frac{1}{2}\int u^{-1/2}du$

$\frac{1}{2}2\, u^{1/2} + C$

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

⑤ $\int \sqrt{1+x^2}\; x\,dx$

$u = 1+x^2$

$du = 2x\,dx$

$du/2 = x\,dx$

$\frac{1}{2}\int u^{\frac{1}{2}}du$

$\frac{1}{2} \cdot \frac{2}{3}u^{3/2} + C$

$\frac{1}{3}(1+x^2)^{3/2} + C$

⑥ $\int \sin 2x\, dx$

$u = 2x$

$du = 2dx$

$\frac{1}{2}\int \sin u\, du$

$-\frac{1}{2}\cos u + C$

$-\frac{1}{2}\cos 2x + C$

⑦ $\int \frac{e^{2x}}{(1+e^{2x})^2}dx$

$u = 1+e^{2x}$

$du = 2e^{2x}dx$

$\frac{1}{2}du = e^{2x}dx$

$\frac{1}{2}\int u^{-2}du$

$\frac{1}{2} \cdot \frac{u^{-1}}{-1} + C$

$\frac{-1}{2u} + C = \frac{-1}{2(1+e^{2x})} + C$

⑧ $\int e^{3x}dx$

$u = 3x$

$du = 3\,dx$

$\frac{1}{3}du = dx$

$\frac{1}{3}\int e^u du$

$\frac{1}{3}e^u + C$

$\frac{1}{3}e^{3x} + C$

⑨ $\int \frac{e^{\frac{1}{x}}}{x^2}dx$

$u = \frac{1}{x},\ x^{-1}$

$du = -x^{-2}dx$

$du = -\frac{1}{x^2}dx$

$-\int e^u du$

$-e^u + C$

$-e^{\frac{1}{x}} + C$

(11) $\int \frac{t\,dt}{\sqrt{2-5t^2}}$

$u = 2-5t^2$

$du = -10t\,dt$

$-du/10 = t\,dt$

*

$-\frac{1}{10}\int u^{-\frac{1}{2}}du$

$-\frac{1}{10} \cdot 2u^{1/2} + C$

$-1/5\,(2-5t^2)^{1/2} + C$

$-\frac{\sqrt{2-5t^2}}{5} + C$

(12) $\int \tan\theta \sec^2\theta \, d\theta$

$u = \tan\theta$

$du = \sec^2\theta\, d\theta$

$\int u\,du$

$\frac{u^2}{2} + C$

$\frac{\tan^2\theta}{2} + C$

(13) $\int \frac{\sin\sqrt{x}}{\sqrt{x}}dx = \int \sin\sqrt{x} \cdot \frac{1}{\sqrt{x}}dx$

$u = \sqrt{x} \Rightarrow x^{1/2}$

$du = \frac{1}{2}x^{-1/2} = \frac{1}{2\sqrt{x}}dx$

$2du = \frac{1}{\sqrt{x}}dx$

$2\int \sin u\,du$

$-2\cos u + C$

$-2\cos\sqrt{x} + C$

(14) $\int \frac{(\ln x)^4}{x}dx$

$u = \ln x$

$du = \frac{1}{x}dx$

$\int u^4\,du$

$u^5/5 + C$

$\frac{(\ln x)^5}{5} + C$ or $\frac{\ln^5 x}{5} + C$

(15) $\int \frac{\sin(\ln x)}{x}dx$ $\int \sin(\ln x) \cdot \frac{1}{x}dx$

$u = \ln x$

$du = \frac{1}{x}dx$

$\int \sin u\,du$

$-\cos u + C$

$-\cos(\ln x) + C$