INTEGRATION

BY REVERSE CHAIN RULE

Question 1

Carry out each of the following integrations.

1. $\int 3x\left(x^2-1\right)^4 \, dx = \frac{3}{10}\left(x^2-1\right)^5 + C$

2. $\int x^2\left(1-4x^3\right)^{-\frac{1}{2}} \, dx = -\frac{1}{6}\left(1-4x^3\right)^{\frac{1}{2}} + C$

3. $\int 4\sin^3 x\cos x \, dx = \sin^4 x + C$

4. $\int \sin x\cos^2 x \, dx = -\frac{1}{3}\cos^3 x + C$

5. $\int \frac{10x}{\sqrt{x^2-7}} \, dx = 10\sqrt{x^2-7} + C$

6. $\int 6x\mathrm{e}^{x^2} \, dx = 3\mathrm{e}^{x^2} + C$

7. $\int \tan^4 x\sec^2 x \, dx = \frac{1}{5}\tan^5 x + C$

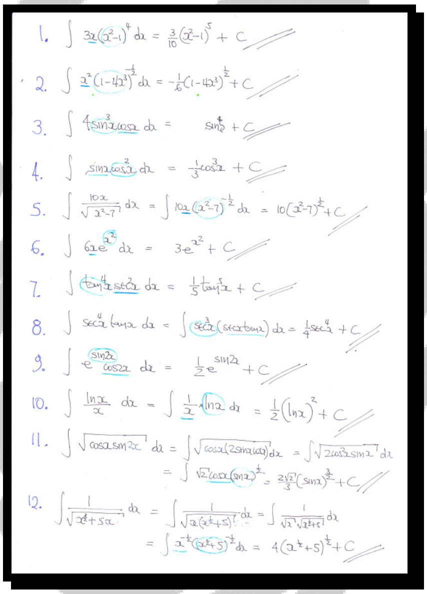
8. $\int \sec^4 x\tan x \, dx = \frac{1}{4}\sec^4 x + C$

9. $\int \mathrm{e}^{\sin 2x}\cos 2x \, dx = \frac{1}{2}\mathrm{e}^{\sin 2x} + C$

10. $\int \frac{\ln x}{x} \, dx = \frac{1}{2}(\ln x)^2 + C$

11. $\int \sqrt{\cos x\sin 2x} \, dx = \frac{2\sqrt{2}}{3}(\sin x)^{\frac{3}{2}} + C$

12. $\int \frac{1}{\sqrt{x^{\frac{3}{2}}+5x}} \, dx = 4\sqrt{x^{\frac{3}{2}}+5x} + C$



1. $\int 3x(x^2-1)^4\,dx = \frac{3}{10}(x^2-1)^5 + C$

2. $\int x^2(1-4x^3)^{-\frac{1}{2}}\,dx = -\frac{1}{6}(1-4x^3)^{\frac{1}{2}} + C$

3. $\int 4\sin^3 x\cos x\,dx = \sin^4 x + C$

4. $\int \sin x\cos^2 x\,dx = -\frac{1}{3}\cos^3 x + C$

5. $\int \frac{10x}{\sqrt{x^2-7}}\,dx = \int 10x(x^2-7)^{-\frac{1}{2}}\,dx = 10(x^2-7)^{\frac{1}{2}} + C$

6. $\int 6xe^{x^2}\,dx = 3e^{x^2} + C$

7. $\int \tan^4 x\sec^2 x\,dx = \frac{1}{5}\tan^5 x + C$

8. $\int \sec^4 x\tan x\,dx = \int \sec^3 x(\sec x\tan x)\,dx = \frac{1}{4}\sec^4 x + C$

9. $\int e^{\sin 2x}\cos 2x\,dx = \frac{1}{2}e^{\sin 2x} + C$

10. $\int \frac{\ln x}{x}\,dx = \int \frac{1}{x}\ln x\,dx = \frac{1}{2}(\ln x)^2 + C$

11. $\int \sqrt{\cos x\sin 2x}\,dx = \int \sqrt{\cos x(2\sin x\cos x)}\,dx = \int \sqrt{2\cos^2 x\sin x}\,dx$
$= \int \sqrt{2}\cos x(\sin x)^{\frac{1}{2}} = \frac{2\sqrt{2}}{3}(\sin x)^{\frac{3}{2}} + C$

12. $\int \frac{1}{\sqrt{x^{\frac{3}{2}}+5x}}\,dx = \int \frac{1}{\sqrt{x(x^{\frac{1}{2}}+5)}}\,dx = \int \frac{1}{\sqrt{x}\sqrt{x^{\frac{1}{2}}+5}}\,dx$
$= \int x^{-\frac{1}{2}}(x^{\frac{1}{2}}+5)^{-\frac{1}{2}}\,dx = 4(x^{\frac{1}{2}}+5)^{\frac{1}{2}} + C$

Question 2

Carry out each of the following integrations.

1. $$\int \frac{x^3}{x^4+2}\,dx = \frac{1}{4}\ln\left(x^4+2\right)+C$$

2. $$\int \frac{x^2}{4-x^3}\,dx = -\frac{1}{3}\ln\left|4-x^3\right|+C$$

3. $$\int \frac{4x}{x^2-1}\,dx = 2\ln\left|x^2-1\right|+C$$

4. $$\int \frac{3x^2}{1+x^3}\,dx = \ln\left|1+x^3\right|+C$$

5. $$\int \frac{3\mathrm{e}^{2x}}{\mathrm{e}^{2x}-1}\,dx = \frac{3}{2}\ln\left|\mathrm{e}^{2x}-1\right|+C$$

6. $$\int \frac{4\sec^2 x}{\tan x}\,dx = 4\ln\left|\tan x\right|+C = 4\ln\sec x+4\ln\sin x+C$$

7. $$\int \frac{x}{9x^2+1}\,dx = \frac{1}{18}\ln\left(9x^2+1\right)+C$$

8. $$\int \frac{\operatorname{cosec}^2 x}{1+\cot x}\,dx = -\ln\left|1+\cot x\right|+C$$

9. $$\int \frac{4x}{x^2-10}\,dx = 2\ln\left|x^2-10\right|+C$$

10. $$\int \frac{2^x}{2^x+1}\,dx = \frac{\ln\left(2^x+1\right)}{\ln 2}+C$$

1. $\int \frac{x^3}{x^4+2}\,dx = \frac{1}{4}\int \frac{4x^3}{x^4+2}\,dx = \frac{1}{4}\ln|x^4+2| + C$

2. $\int \frac{x^2}{4-x^3}\,dx = -\frac{1}{3}\int \frac{-3x^2}{4-x^3}\,dx = -\frac{1}{3}\ln|4-x^3| + C$

3. $\int \frac{4x}{x^2-1}\,dx = 2\int \frac{2x}{x^2-1}\,dx = 2\ln|x^2-1| + C$

4. $\int \frac{3x^2}{1+x^3}\,dx = \ln|1+x^3| + C$

5. $\int \frac{3e^{2x}}{e^{2x}-1}\,dx = \frac{3}{2}\int \frac{e^{2x}}{e^{2x}-1}\,dx = \frac{3}{2}\ln|e^{2x}-1| + C$

6. $\int \frac{4\sec^2 x}{\tan x}\,dx = 4\int \frac{\sec^2 x}{\tan x}\,dx = 4\ln|\tan x| + C$

7. $\int \frac{x}{9x^2+1}\,dx = \frac{1}{18}\int \frac{18x}{9x^2+1}\,dx = \frac{1}{18}\ln|9x^2+1| + C$

8. $\int \frac{\operatorname{cosec}^2 x}{1+\cot x}\,dx = -\int \frac{-\operatorname{cosec}^2 x}{1+\cot x}\,dx = -\ln|1+\cot x| + C$

9. $\int \frac{4x}{x^2-10}\,dx = 2\int \frac{2x}{x^2-10}\,dx = 2\ln|x^2-10| + C$

10. $\int \frac{2^x}{2^x+1}\,dx = \frac{1}{\ln 2}\int \frac{2^x \ln 2}{2^x+1}\,dx = \frac{1}{\ln 2}\ln|2^x+1| + C$

Question 3

Carry out each of the following integrations.

1. $\displaystyle\int \frac{x}{x^2-9}\,dx = \frac{1}{2}\ln\left|x^2-9\right| + C$

2. $\displaystyle\int \frac{10x}{x^2-9}\,dx = 5\ln\left|x^2-9\right| + C$

3. $\displaystyle\int \frac{3x}{4-2x^2}\,dx = -\frac{3}{4}\ln\left|4-2x^2\right| + C$

4. $\displaystyle\int \frac{x^2}{x^3+1}\,dx = \frac{1}{3}\ln\left|x^3+1\right| + C$

5. $\displaystyle\int \frac{2x+6}{x^2+6x+1}\,dx = \ln\left|x^2+6x+1\right| + C$

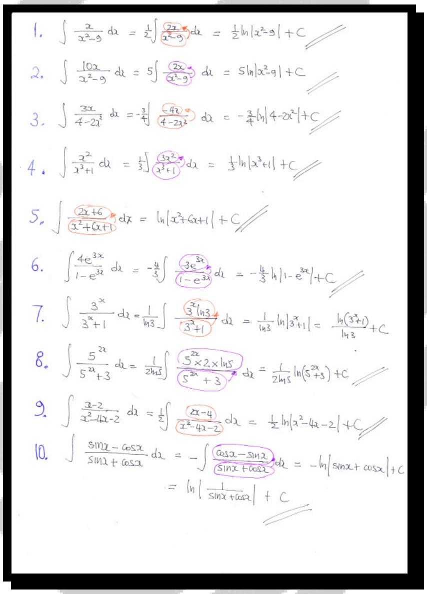
6. $\displaystyle\int \frac{4\mathrm{e}^{3x}}{1-\mathrm{e}^{3x}}\,dx = -\frac{4}{3}\ln\left|1-\mathrm{e}^{3x}\right| + C$

7. $\displaystyle\int \frac{3^x}{3^x+1}\,dx = \frac{\ln\left(3^x+1\right)}{\ln 3} + C$

8. $\displaystyle\int \frac{5^{2x}}{5^{2x}+3}\,dx = \frac{\ln\left(5^{2x}+3\right)}{\ln 25} + C$

9. $\displaystyle\int \frac{x-2}{x^2-4x-2}\,dx = \frac{1}{2}\ln\left|x^2-4x-2\right| + C$

10. $\displaystyle\int \frac{\sin x-\cos x}{\sin x+\cos x}\,dx = -\ln\left|\sin x+\cos x\right| + C$



1. $\int \frac{x}{x^2-9}\,dx = \frac{1}{2}\int \frac{2x}{x^2-9}\,dx = \frac{1}{2}\ln|x^2-9| + C$

2. $\int \frac{10x}{x^2-9}\,dx = 5\int \frac{2x}{x^2-9}\,dx = 5\ln|x^2-9| + C$

3. $\int \frac{3x}{4-2x^2}\,dx = -\frac{3}{4}\int \frac{-4x}{4-2x^2}\,dx = -\frac{3}{4}\ln|4-2x^2| + C$

4. $\int \frac{x^2}{x^3+1}\,dx = \frac{1}{3}\int \frac{3x^2}{x^3+1}\,dx = \frac{1}{3}\ln|x^3+1| + C$

5. $\int \frac{2x+6}{x^2+6x+1}\,dx = \ln|x^2+6x+1| + C$

6. $\int \frac{4e^{3x}}{1-e^{3x}}\,dx = -\frac{4}{3}\int \frac{-3e^{3x}}{1-e^{3x}}\,dx = -\frac{4}{3}\ln|1-e^{3x}| + C$

7. $\int \frac{3^x}{3^x+1}\,dx = \frac{1}{\ln 3}\int \frac{3^x \ln 3}{3^x+1}\,dx = \frac{1}{\ln 3}\ln|3^x+1| = \frac{\ln(3^x+1)}{\ln 3} + C$

8. $\int \frac{5^{2x}}{5^{2x}+3}\,dx = \frac{1}{2\ln 5}\int \frac{5^{2x}\times 2\times \ln 5}{5^{2x}+3}\,dx = \frac{1}{2\ln 5}\ln(5^{2x}+3) + C$

9. $\int \frac{x-2}{x^2-4x-2}\,dx = \frac{1}{2}\int \frac{2x-4}{x^2-4x-2}\,dx = \frac{1}{2}\ln|x^2-4x-2| + C$

10. $\int \frac{\sin x - \cos x}{\sin x + \cos x}\,dx = -\int \frac{\cos x - \sin x}{\sin x + \cos x}\,dx = -\ln|\sin x + \cos x| + C$
$= \ln\left|\frac{1}{\sin x + \cos x}\right| + C$

Question 4

Carry out each of the following integrations.

1. $\displaystyle\int \frac{x}{\left(x^2-1\right)^3}\,dx = -\frac{1}{4}\left(x^2-1\right)^{-2} + C$

2. $\displaystyle\int \cos x \sin x\,dx = \frac{1}{2}\sin^2 x + C = -\frac{1}{2}\cos^2 x + C = -\frac{1}{4}\cos 2x + C$

3. $\displaystyle\int \frac{4x}{\sqrt{1-2x^2}}\,dx = -2\sqrt{1-2x^2} + C$

4. $\displaystyle\int \sec^2 x\left(1+\tan^2 x\right)\,dx = \tan x + \frac{1}{3}\tan^3 x + C$

5. $\displaystyle\int \sec^2 x\left(1+\tan x\right)\,dx = \frac{1}{2}\left(1+\tan x\right)^2 + C$

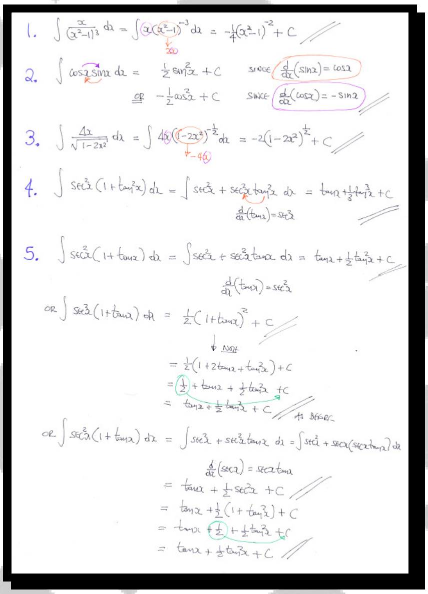
6. $\displaystyle\int \sec x \tan x\sqrt{\sec x + 1}\,dx = \frac{2}{3}\left(\sec x + 1\right)^{\frac{3}{2}} + C$

7. $\displaystyle\int \tan^2 x \sec^2 x\,dx = \frac{1}{3}\tan^3 x + C$

8. $\displaystyle\int e^{\sin x}\cos x\,dx = e^{\sin x} + C$

9. $\displaystyle\int \sqrt{\sin x \cos^2 x}\,dx = \frac{2}{3}\left(\sin x\right)^{\frac{3}{2}} + C$

10. $\displaystyle\int (2x+1)\left(x^2+x+1\right)\,dx = \frac{1}{2}\left(x^2+x+1\right)^2 + C = \frac{1}{2}x^4 + x^3 + \frac{3}{2}x^2 + x + C$



1. $\int \frac{x}{(x^2-1)^3}\,dx = \int x(x^2-1)^{-3}\,dx = -\frac{1}{4}(x^2-1)^{-2} + C$

2. $\int \cos x \sin x\,dx = \frac{1}{2}\sin^2 x + C$ SINCE $\frac{d}{dx}(\sin x) = \cos x$

OR $-\frac{1}{2}\cos^2 x + C$ SINCE $\frac{d}{dx}(\cos x) = -\sin x$

3. $\int \frac{4x}{\sqrt{1-2x^2}}\,dx = \int 4x(1-2x^2)^{-\frac{1}{2}}\,dx = -2(1-2x^2)^{\frac{1}{2}} + C$

4. $\int \sec^2 x(1+\tan^2 x)\,dx = \int \sec^2 x + \sec^2 x \tan^2 x\,dx = \tan x + \frac{1}{3}\tan^3 x + C$

$\frac{d}{dx}(\tan x) = \sec^2 x$

5. $\int \sec^2 x(1+\tan x)\,dx = \int \sec^2 x + \sec^2 x \tan x\,dx = \tan x + \frac{1}{2}\tan^2 x + C$

$\frac{d}{dx}(\tan x) = \sec^2 x$

OR $\int \sec^2 x(1+\tan x)\,dx = \frac{1}{2}(1+\tan x)^2 + C$

NOTE

$= \frac{1}{2}(1 + 2\tan x + \tan^2 x) + C$

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

$= \tan x + \frac{1}{2}\tan^2 x + C$ AS BEFORE

OR $\int \sec^2 x(1+\tan x)\,dx = \int \sec^2 x + \sec^2 x \tan x\,dx = \int \sec^2 x + \sec x(\sec x \tan x)\,dx$

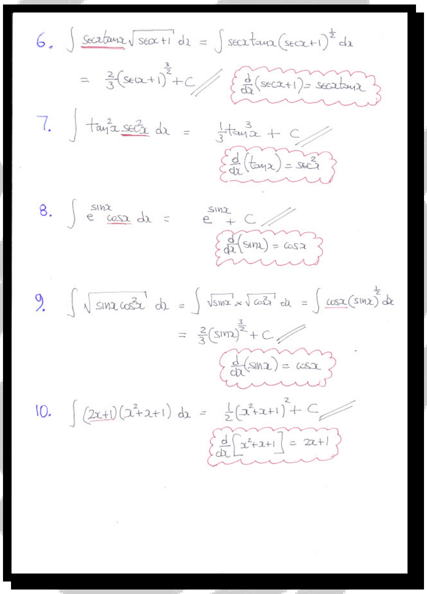
$\frac{d}{dx}(\sec x) = \sec x \tan x$

$= \tan x + \frac{1}{2}\sec^2 x + C$

$= \tan x + \frac{1}{2}(1+\tan^2 x) + C$

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

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



6. $\int \sec x \tan x \sqrt{\sec x + 1}\,dx = \int \sec x \tan x (\sec x + 1)^{\frac{1}{2}}\,dx$

$= \frac{2}{3}(\sec x + 1)^{\frac{3}{2}} + C$ $\quad \frac{d}{dx}(\sec x + 1) = \sec x \tan x$

7. $\int \tan^2 x \sec^2 x\,dx = \frac{1}{3}\tan^3 x + C$

$\frac{d}{dx}(\tan x) = \sec^2 x$

8. $\int e^{\sin x}\cos x\,dx = e^{\sin x} + C$

$\frac{d}{dx}(\sin x) = \cos x$

9. $\int \sqrt{\sin x \cos^2 x}\,dx = \int \sqrt{\sin x} \times \sqrt{\cos^2 x}\,dx = \int \cos x(\sin x)^{\frac{1}{2}}\,dx$

$= \frac{2}{3}(\sin x)^{\frac{3}{2}} + C$

$\frac{d}{dx}(\sin x) = \cos x$

10. $\int (2x+1)(x^2+x+1)\,dx = \frac{1}{2}(x^2+x+1)^2 + C$

$\frac{d}{dx}\left[x^2+x+1\right] = 2x+1$

Question 5

Carry out each of the following integrations.

1. $\int (2x+1)\sin\left(x^2+x+1\right)\,dx = -\cos\left(x^2+x+1\right)+C$

2. $\int (x+1)\cos\left(x^2+2x+1\right)\,dx = \frac{1}{2}\sin\left(x^2+2x+1\right)+C$

3. $\int \frac{1}{x(1+\ln x)^3}\,dx = -\frac{1}{2(1+\ln x)^2}+C$

4. $\int 4-\cos^4 x\sin x\,dx = 4x+\frac{1}{5}\cos^5 x+C$

5. $\int \frac{\cos x}{\sin^3 x}\,dx = -\frac{1}{2}\text{cosec}^2 x+C = -\frac{1}{2}\cot^2 x+C$

6. $\int \frac{\sqrt{1+2\tan x}}{\cos^2 x}\,dx = \frac{1}{3}(1+2\tan x)^{\frac{3}{2}}+C$

7. $\int \frac{\cos x}{\sqrt{\sin x}}\,dx = 2\sqrt{\sin x}+C$

8. $\int \frac{1}{x\ln x}\,dx = \ln\left|\ln|x|\right|+C$

9. $\int \frac{1}{\cos^2 x\tan^4 x}\,dx = -\frac{1}{3\tan^3 x}+C$

10. $\int \sin^3 2x\cos 2x\,dx = \frac{1}{8}\sin^4 2x+C$

1. $$\int (2x+1)\sin(x^2+x+1)\,dx = -\cos(x^2+x+1) + C$$

$$\frac{d}{dx}(x^2+x+1) = 2x+1$$

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

$$= \frac{1}{2}\sin(x^2+2x+1) + C$$

$$\frac{d}{dx}(x^2+2x+1) = 2x+2 = 2(x+1)$$

3. $$\int \frac{1}{x(1+\ln x)^3}\,dx = \int \frac{1}{x}\times(1+\ln x)^{-3}\,dx$$

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

$$\frac{d}{dx}(1+\ln x) = \frac{1}{x}$$

4. $$\int 4 - \cos^4 x\sin x\,dx = 4x + \frac{1}{5}\cos^5 x + C$$

$$\frac{d}{dx}(\cos x) = -\sin x$$

5. $$\int \frac{\cos x}{\sin^3 x}\,dx = \int \cos x(\sin x)^{-3}\,dx$$

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

$$\frac{d}{dx}(\sin x) = \cos x$$

6. $$\int \frac{\sqrt{1+2\tan x}}{\cos^2 x}\,dx = \int \sec^2 x\,(1+2\tan x)^{\frac{1}{2}}\,dx$$

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

$$\frac{d}{dx}(1+2\tan x) = 2\sec^2 x$$

7. $$\int \frac{\cos x}{\sqrt{\sin x}}\,dx = \int \cos x(\sin x)^{-\frac{1}{2}}\,dx = 2(\sin x)^{\frac{1}{2}} + C$$

$$= 2\sqrt{\sin x} + C$$

$$\frac{d}{dx}(\sin x) = \cos x$$

8. $$\int \frac{1}{x\ln x}\,dx = \int \frac{1}{x}\times\frac{1}{\ln x}\,dx = \ln|\ln|x|| + C$$

$$\frac{d}{dx}[\ln(\ln x)] = \frac{1}{\ln x}\times\frac{1}{x}$$

9. $$\int \frac{1}{\cos^2 x\tan^4 x}\,dx = \int \sec^2 x(\tan x)^{-4}\,dx = -\frac{1}{3}(\tan x)^{-3} + C$$

$$= -\frac{1}{3\tan^3 x} + C$$

$$\frac{d}{dx}(\tan x) = \sec^2 x$$

10. $$\int \sin^3 2x\cos 2x\,dx = \frac{1}{8}\sin^4 2x + C$$

$$\frac{d}{dx}(\sin 2x) = 2\cos 2x$$

Question 6

Carry out each of the following integrations.

1. $\displaystyle\int \frac{\cos(\ln x)}{x}\,dx = \sin(\ln x) + C$

2. $\displaystyle\int \frac{3x}{\sqrt{4-2x^2}}\,dx = -\frac{3}{2}\sqrt{4-2x^2} + C$

3. $\displaystyle\int \frac{\sin x}{\cos^4 x}\,dx = \frac{1}{3}\sec^3 x + C$

4. $\displaystyle\int \cos x \sin^3 x\,dx = \frac{1}{4}\sin^4 x + C$

5. $\displaystyle\int \frac{\sin^2 x}{\cos^4 x}\,dx = \frac{1}{3}\tan^3 x + C$

6. $\displaystyle\int e^x \sin(e^x)\,dx = -\cos(e^x) + C$

7. $\displaystyle\int \sin 2x \cos^4 2x\,dx = -\frac{1}{10}\cos^5 2x + C$

8. $\displaystyle\int 3x^2\left(4-2x^3\right)^{\frac{3}{2}}\,dx = -\frac{1}{5}\left(4-2x^3\right)^{\frac{5}{2}} + C$

9. $\displaystyle\int \frac{x+1}{\sqrt[3]{x^2+2x+3}}\,dx = \frac{3}{4}\sqrt[3]{\left(x^2+2x+3\right)^2} + C$

10. $\displaystyle\int \sin 2x \cos 2x\,dx = \frac{1}{4}\sin^2 2x + C \quad \text{or} \quad -\frac{1}{8}\cos 4x + C$

Question 7

Carry out each of the following integrations.

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

2. $\int (x+1)\left(x^2+2x+1\right)^4\,dx = \frac{1}{10}\left(x^2+2x+1\right)^5 + C$

3. $\int \sin x\cos^4 x\,dx = -\frac{1}{5}\cos^5 x + C$

4. $\int \sec^3 x\tan x\,dx = \frac{1}{3}\sec^3 x + C$

5. $\int x\left(3+x^2\right)^4\,dx = \frac{1}{10}\left(3+x^2\right)^5 + C$

6. $\int \frac{\cos x}{\sqrt{\sin^3 x}}\,dx = -\frac{2}{\sqrt{\sin x}} + C$

7. $\int \cos x\sqrt{\sin x}\,dx = \frac{2}{3}\sqrt{\sin^3 x} + C$

8. $\int \frac{\sec^2 x}{(1+\tan x)^3}\,dx = -\frac{1}{2(1+\tan x)^2} + C$

9. $\int \frac{\sin x\cos x}{\sqrt{\cos 2x+1}}\,dx = -\frac{1}{2}\sqrt{\cos 2x+1} + C = -\frac{\sqrt{2}}{2}\cos x$

10. $\int \frac{\ln x^2}{x}\,dx = (\ln x)^2 + C$

Question 8

Carry out each of the following integrations.

1. $\int 3x^2\left(4-2x^3\right)^{\frac{3}{2}}\ dx = -\frac{1}{5}\left(4-2x^3\right)^{\frac{5}{2}}+C$

2. $\int \frac{e^{\sqrt{x}}}{\sqrt{x}}\ dx = 2e^{\sqrt{x}}+C$

3. $\int \frac{\sqrt{\sqrt{x}+1}}{\sqrt{x}}\ dx = \frac{4}{3}\left(x^{\frac{1}{2}}+1\right)^{\frac{3}{2}}+C$

4. $\int \frac{x}{\sqrt{x^2+1}}\ dx = \sqrt{x^2+1}+C$

5. $\int \frac{1}{\sqrt{x}\cos^2\sqrt{x}}\ dx = 2\tan\sqrt{x}+C$

6. $\int \frac{x}{\sqrt{x^2+1}}\ dx = \sqrt{x^2+1}+C$

7. $\int \frac{1}{\sqrt{x}\sqrt{\sqrt{x}+1}}\ dx = 4\sqrt{\sqrt{x}+1}+C$

8. $\int \frac{\sin x}{\cos^5 x}\ dx = \frac{1}{4}\sec^4 x+C$

9. $\int x\sqrt{1-x^2}\ dx = -\frac{1}{3}\left(1-x^2\right)^{\frac{3}{2}}+C$

10. $\int \sqrt{\frac{2\sqrt{x}+3}{4x}}\ dx = \frac{2}{3}\left(2x^{\frac{1}{2}}+3\right)^{\frac{3}{2}}+C$

Question 9

Carry out each of the following integrations.

1. $$\int_0^2 \frac{2x}{\sqrt{x^2+4}}\,dx = 4\left(\sqrt{2}-1\right)$$

2. $$\int_0^{36} \frac{1}{\sqrt{x}\left(\sqrt{x}+2\right)}\,dx = \ln 16$$

3. $$\int_0^3 \frac{x}{x^2+9}\,dx = \frac{1}{2}\ln 2$$