Practice Integration Problems (solutions at end)

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

2. $\int (\csc^2 x - 2 \sin x) dx$

3. $\int 3e^x dx$

4. $\int \frac{-3}{x} dx$

5. $\int \frac{3x^2 - 4x^{\frac{1}{2}} + 2}{x} dx$

6. $\int \frac{3x^2 - x + 2}{x+1} dx$

7. $\int \frac{2x+1}{x^2+x-14} dx$

8. $\int \frac{x^2+2}{x+1} dx$

9. $\int (e^{2x} - \cos x)dx$

10. $\int x^{\frac{1}{2}}(x - 3)dx$

11. $\int x(e^{x^2} - \sec^2 x^2)dx$

12. $\int \frac{xe^{-x}-1}{x}dx$

13. $\int \frac{\sqrt{\ln x}}{x}dx$

14. $\int \sin \theta \cos \theta \, d\theta$

Practice Integration Problems – solutions

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

2. $\int (csc^2 x - 2\sin x) dx = -\cot x - 2(-\cos x) + C$ (trig rules)

3. $\int 3e^x dx = 3e^x + C$ (exponential rule)

4. $\int \frac{-3}{x} dx = -3lnx + C$ (logarithm rule)

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

                                       (simple division, power rule, logarithm rule)

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

                                        (long division, power rule, logarithm rule)

7. $\int \frac{2x+1}{x^2+x-14} dx = \int \frac{1}{u} du = ln|u| + C = ln|x^2 + x - 14| + C$

                                        (u-sub with u $= x^2 + $ x $- 14$)

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

                                        (long division, power rule, logarithm rule)

9. $\int (e^{2x} - \cos x) dx = \frac{e^{2x}}{2} - \sin x + C$

                                        (exponent, u-sub with u $= 2x$, trig rules)

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

                                        (multiplication, power rule)

11. $\int x\left(e^{x^2} - \sec^2 x^2\right)dx = \int xe^{x^2} - x\sec^2 x^2\, dx = \dfrac{e^{x^2}}{2} - \dfrac{\tan x^2}{2} + C$

(multiplication, u-sub in each part of u = x², exponent rule, trig rule)

12. $\int \dfrac{xe^{-x}-1}{x}dx = \int e^{-x} + \dfrac{-1}{x}dx = -e^{-x} - \ln|x| + C$ (simple division, u-sub with u = –x, logarithm rule)

13. $\int \dfrac{\sqrt{\ln x}}{x}dx = \int u^{\frac{1}{2}}du = \dfrac{u^{\frac{1}{2}+1}}{\frac{3}{2}} + C = \dfrac{(\ln x)^{\frac{3}{2}}}{\frac{2}{3}} + C$ (u-sub with u = lnx, power rule)

14. $\int \sin\theta \cos\theta\, d\theta = \int u\, du = \dfrac{u^2}{2} + C = \dfrac{\sin^2\theta}{2} + C$ (u-sub with u = sinθ, power rule)