

Task 1A.

i) Let $f(x) = 6x^8$.

Differentiating the function $f(x)$ with respect to x , gives, $f'(x) = (6)(8)x^7$; or, $f'(x) = 48x^7$.

Thus, differentiating $6x^8$, we get, $48x^7$.

ii) Let $f(x) = 2e^{\cos(4x)}$.

Differentiating the function $f(x)$ with respect to x , gives, $f'(x) = (2e^{\cos(4x)})(-\sin(4x))(4)$; or, $f'(x) = -8e^{\cos(4x)}\sin(4x)$. Thus, differentiating $2e^{\cos(4x)}$, we get, $-8e^{\cos(4x)}\sin(4x)$.

iii) Let $f(x) = \ln \cos(5x)$.

Differentiating the function $f(x)$ with respect to x , gives, $f'(x) = \frac{(-\sin(5x))(5)}{\cos(5x)}$;

or, $f'(x) = \frac{-5\sin(5x)}{\cos(5x)} = -5\tan(5x)$. Thus, differentiating $\ln \cos(5x)$, we get, $-5\tan(5x)$.

iv) Let $f(x) = (4x^2 + 3x - 8)^2$.

Differentiating the function $f(x)$ with respect to x , gives, $f'(x) = (2)(4x^2 + 3x - 8)(8x + 3)$; or, $f'(x) = (16x + 6)(4x^2 + 3x - 8) = 64x^3 + 72x^2 - 110x - 48$.

Thus, differentiating $(4x^2 + 3x - 8)^2$, we get, $64x^3 + 72x^2 - 110x - 48$.

Task 1B.

i) $\int_2^5 (4x^2 + 3x - 9)dx = \left[\frac{4}{3}x^3 + \frac{3}{2}x^2 - 9x\right]_2^5 = \frac{4}{3}(5^3 - 2^3) + \frac{3}{2}(5^2 - 2^2) - 9(5 - 2)$;
or, $\int_2^5 (4x^2 + 3x - 9)dx = 156 + \frac{63}{2} - 27 = 129 + \frac{63}{2} = \frac{321}{2}$;
Thus, $\int_2^5 (4x^2 + 3x - 9)dx = \frac{321}{2}$.

ii) $\int (3 - 4x)^4 dx$. Let $3 - 4x = z$; then $-4dx = dz$;
or, $\int (3 - 4x)^4 dx = -\frac{1}{4} \int z^4 dz = -\frac{1}{20} z^5 + C$, where C is some constant.
Inserting the value of z , we get, $\int (3 - 4x)^4 dx = -\frac{1}{20} (3 - 4x)^5 + C$.

iii) In this problem we will use integration by parts.

$$\int x^2 e^{4x} dx = x^2 \int e^{4x} dx - \int \frac{d}{dx}(x^2) [\int e^{4x} dx] dx = \frac{x^2 e^{4x}}{4} - \frac{1}{2} \int x e^{4x} dx; \text{ or,}$$

$$\frac{x^2 e^{4x}}{4} - \frac{1}{2} \int x e^{4x} dx = \frac{x^2 e^{4x}}{4} - \frac{1}{2} \left\{ x \int e^{4x} dx - \int \frac{d}{dx}(x) [\int e^{4x} dx] dx \right\}; \text{ or,}$$

$$\frac{x^2 e^{4x}}{4} - \frac{1}{2} \int x e^{4x} dx = \frac{x^2 e^{4x}}{4} - \frac{1}{2} \left\{ \frac{x e^{4x}}{4} - \frac{e^{4x}}{16} \right\} + C, \text{ where } C \text{ is some constant;}$$

$$\text{Therefore, } \int x^2 e^{4x} dx = \frac{e^{4x}}{32} (8x^2 - 4x + 1) + C.$$

iv) $\int \sin(4x - 9) dx$. Let $(4x - 9) = z$; then $4dx = dz$; or,

$$\int \sin(4x - 9) dx = \frac{1}{4} \int \sin(z) dz = -\frac{\cos(z)}{4} + C, \text{ where } C \text{ is some constant.}$$

$$\text{Inserting the value of } z, \text{ we get, } \int \sin(4x - 9) dx = -\frac{\cos(4x-9)}{4} + C.$$