

1. Find the derivative of the following functions.

$$(a) y = 3 - 0.7x^3 + 0.3x^7 \quad (b) y = (2x - 5)(4 - x)^{-1} \quad (c) y = \frac{1}{\sqrt{t} - 1}$$

$$(d) y = \frac{1}{\sin^2 x} - \frac{2}{\sin x} \quad (e) s = (\sec t + \tan t)^5 \quad (f) r = \sqrt{2\theta \sin 2\theta}$$

$$(g) r = \sin \sqrt{2\theta} \quad (h) r = \cos(\theta + \sqrt{\theta + 1}) \quad (i) y = x^{-2} \sin^2(x^3) \quad (j) y = \left(\frac{2\sqrt{x}}{2\sqrt{x} + 1} \right)^2$$

$$(k) y = 2(\ln x)^{x/2} \quad (l) y = t \tan^{-1} t - \frac{1}{2} \ln t \quad (m) y = \frac{1}{4} x e^{4x} - \frac{1}{16} e^{4x} \quad (n) r = \left(\frac{1 + \sin \theta}{1 - \cos \theta} \right)^2$$

2. Find the indefinite or definite integrals. Check your answers by differentiations if possible.

$$(a) \int \left(\frac{3}{x} - x \right) dx \quad (b) \int \left(\frac{5}{x^2} + \frac{2}{x^2 + 1} \right) dx \quad (c) \int (5^s + s^5) ds \quad (d) \int \sec^2 5x dx$$

$$(e) \int \left(3\sqrt{t} + \frac{4}{t^3} \right) dt \quad (f) \int \left(\frac{1}{2} e^t - e^{-t} \right) dt \quad (g) \int_0^\pi (2 \cos 2x - 3 \sin 3x) dx$$

$$(h) \int \left(\frac{1 - \cos 6x}{2} \right) dx \quad (i) \int x^{-3} (x + 1) dx \quad (j) \int_1^4 \left(\frac{4 + \sqrt{t}}{t^3} \right) dt \quad (k) \int \frac{x + 1}{x^2 + 1} dx$$

3. Suppose that functions $f(x)$ and $g(x)$ and their first derivatives have the following values at $x = 0$ and $x = 1$. Find the first derivatives of the following combinations at the given value of x .

$$(a) f(x)g^2(x) \text{ at } x=0 \quad (b) \frac{f(x)}{g(x)+1} \text{ at } x=1 \quad (c) f(g(x)) \text{ at } x=0$$

$$(d) f(x + g(x)) \text{ at } x=0$$

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
0	1	1	-3	1/2
1	3	5	1/2	-4

There are more practice problems in page 324 #11-20 and page 414 #37-57.

Please prepare well for this exam! Without knowing these basics, you will encounter difficulties for the future materials of this course.

Answer key

1. (a) $-2.1x^2 + 2.1x^6$ (b) $2(4-x)^{-1} + (2x-5)(4-x)^{-2}$ (c) $-(\sqrt{t}-1)^{-2} \frac{1}{2\sqrt{t}}$

(d) $-2(\sin x)^{-3} \cos x + 2(\sin x)^{-2} \cos x$ (e) $5(\sec t + \tan t)^4 (\sec t \tan t + \sec^2 t)$

(f) $(2\theta \sin 2\theta)^{-1/2} (\sin 2\theta + 2\theta \cos 2\theta)$ (g) $\cos \sqrt{2\theta} \cdot \frac{1}{\sqrt{2\theta}}$ (h) $-\sin(\theta + \sqrt{\theta+1}) \cdot (1 + \frac{1}{2\sqrt{\theta+1}})$

(i) $-2x^{-3} \sin^2(x^3) + 6\sin(x^3) \cos(x^3)$ (j) $\frac{4}{(2\sqrt{x}+1)^3}$ (k) $(\ln x)^{x/2} (\ln |\ln x| + \frac{1}{\ln x})$

(l) $\tan^{-1} t + \frac{t}{t^2+1} - \frac{1}{2t}$ (m) xe^{4x} (n) $\frac{2(1+\sin \theta)(\cos \theta - \sin \theta - 1)}{(1-\cos \theta)^3}$

2. (a) $3\ln x - \frac{1}{2}x^2 + C$ (b) $-\frac{5}{x} + 2\tan^{-1} x + C$ (c) $\frac{1}{\ln 5}5^s + \frac{1}{6}s^6 + C$ (d) $\frac{1}{5}\tan 5x + C$

(e) $2t^{3/2} - \frac{2}{t^2} + C$ (f) $\frac{1}{2}e^t + e^{-t} + C$ (g) -2 (h) $\frac{1}{2}x - \frac{1}{12}\sin 6x + C$ (i) $-\frac{1}{x} - \frac{1}{2x^2} + C$ (j) $59/24$

(k) $\frac{1}{2}\ln(x^2+1) + \tan^{-1} x + c$

3. (a) -2 (b) $5/12$ (c) $1/4$ (d) $3/4$