

CALCULUS PROBLEMS

1. Calculate the derivative of $d(2x^3)/dx$ at $x=1$ (a) by approximating it numerically by calculating $\Delta(2x^3)/\Delta x$ for $\Delta x=0.1, 0.01, 0.001$ and (b) analytically by differentiating the function. How do these results compare?
2. Differentiate the following functions with respect to x :
(a) x^2+4x+6 , (b) $\sin(3x)$, (c) $\tan x$, (d) e^{5x} , (e) $1/x^2$, (f) $\ln x^3$,
(g) $x\sin x$.
3. Calculate the integral $\int x^2 dx$ on the interval $[0,1]$ (a) by approximating the area under the curve of $y(x)=x^2$ using 5 rectangles of width $\Delta x=0.2$ and (b) analytically. How do these results compare?
4. Find the indefinite integral of the following functions:
(a) x^2+4x+6 , (b) $\sin(3x)$, (c) e^{5x} , (d) $1/x^2$, (e) $5/x$, (f) $x/(1+x^2)^4$.
5. Find the definite integral of the functions of problem 4 on the interval $[1, 2]$.
6. Find the extrema of the functions (a) $1/(x^2+8)$, (b) $\cos \pi x$.

ANSWERS to SELECTED PROBLEMS

2. The derivatives with respect to x are (a) $2x+4$, (b) $3\cos 3x$,
(c) $\sec^2 x$ (the trick here is recognize the $\tan x = \sin x / \cos x$),
(d) $5e^{5x}$, (e) $-2/x^3$, (f) $3/x$, (g) $x\cos x + \sin x$.
4. (a) $(x^3+6x^2+18x)/3$, (b) $-\cos 3x/3$, (c) $e^{5x}/5$, (d) $-1/x$, (e) $5(\ln x)$,
(f) $-1/[6(1+x^2)^3]$.
5. (a) $43/3$, (b) $-0.650\dots$, (c) $4375.6\dots$, (d) $1/2$, (e) $3.46\dots$,
(f) $39/2000=0.0195$.
6. (a) maximum at $(0, 1/8)$, (b) extrema at $x=0, \pm 1, \pm 2, \pm 3, \dots$