MATHEMATICS 201-NYB-05
Integral Calculus
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Winter 2012

Review of Differential Calculus

1. Find $\frac{dy}{dx}$.

a) $y = 3x^2 - \sqrt{x} + \frac{2}{x^4} + 4$

b) $y = \sqrt{2}x^2 - x^{\frac{1}{3}} - \frac{1}{\sqrt[5]{x^2}}$

c) $y = \left(2x^3 - 2\right)^{12}$

d) $y = \sqrt{3x-4}$

e) $y = \frac{x^2 - 5}{2x^3 + 1}$

f) $y = \ln\left(x^2 + 3\right)$

g) $y = 4^{3x+1}$

h) $y = x^2 \sin x$

i) $y = \sqrt{\cos x^2}$

j) $y = \tan^2 3x$

k) $y = \ln\left(\csc 5x\right)$

l) $y = e^{\cos x} + \cos\left(e^x\right)$

m) $y = \log_2 \sec x + \frac{1}{1+\cot x}$

n) $y = \arcsin x^2 - x \arccos x$

o) $y = \ln\left(\arcsin \sqrt{x}\right)$

p) $y = \arctan \frac{1}{x}$

q) $y = \sqrt{\ln x} + \ln\sqrt{x} + \sqrt{x}\ln x$

r) $y = \left(\sin x\right)^{\tan x}$

s) $y = \operatorname{arccot}\left(\frac{x^2+1}{x^2-1}\right) + \operatorname{arccsc}\left(\frac{1+x^4}{1-x^4}\right)$

t) $y = \ln\left(\frac{x^3 \sin^4 x \cos^5 x}{e^{6x}}\right)$

u) $y = \sin^4(3x)\cos^7(3x)$

v) $y = \sec^6\left(x^3\right)\tan^3\left(x^3\right)$

2. Find the differential dy.

a) $y = x^3 - \frac{1}{x} + \ln x$

b) $y = \sqrt{\frac{x-3}{x+3}}$

c) $y = \arctan 2x$

d) $y = \cot\sqrt{3x}$

e) $y = \sin 2x \cos 3x$

f) $y = \operatorname{arcsec} e^x$

Answers

1. a) $\frac{dy}{dx}=6x-\frac{1}{2\sqrt{x}}-\frac{8}{x^5}$

   b) $\frac{dy}{dx}=2\sqrt{2}x-\frac{1}{3x^{\frac{2}{3}}}+\frac{2}{5x\sqrt[5]{x^2}}$

   c) $\frac{dy}{dx}=72x^2\left(2x^3-2\right)^{11}$

   d) $\frac{dy}{dx}=\frac{3}{2\sqrt{3x-4}}$

   e) $\frac{dy}{dx}=\frac{-2x\left(x^3-15x-1\right)}{\left(2x^3+1\right)^2}$

   f) $\frac{dy}{dx}=\frac{2x}{x^2+3}$

   g) $\frac{dy}{dx}=4^{3x+1}3\ln 4$

   h) $\frac{dy}{dx}=2x\sin x+x^2\cos x$

   i) $\frac{dy}{dx}=\frac{-x\sin x^2}{\sqrt{\cos x^2}}$

   j) $\frac{dy}{dx}=6\tan 3x\sec^2 3x$

   k) $\frac{dy}{dx}=-5\cot 5x$

   l) $\frac{dy}{dx}=-\sin x e^{\cos x}-e^x\sin\left(e^x\right)$

   m) $\frac{dy}{dx}=\frac{\tan x}{\ln 2}+\frac{\csc^2 x}{(1+\cot x)^2}$

   n) $\frac{dy}{dx}=\frac{2x}{\sqrt{1-x^4}}-\arccos x+\frac{x}{\sqrt{1-x^2}}$

   o) $\frac{dy}{dx}=\frac{1}{2\sqrt{x-x^2}\arcsin\sqrt{x}}$

   p) $\frac{dy}{dx}=\frac{-1}{x^2+1}$

   q) $\frac{dy}{dx}=\frac{1}{2x\sqrt{\ln x}}+\frac{1}{2x}+\frac{\ln x}{2\sqrt{x}}+\frac{1}{\sqrt{x}}$

   r) $\frac{dy}{dx}=(\sin x)^{\tan x}\left(\sec^2 x\ln(\sin x)+1\right)$

   s) $\frac{dy}{dx}=\frac{-2x}{x^4+1}$

   t) $\frac{dy}{dx}=\frac{3}{x}+4\cot x-5\tan x-6$

   u) $\frac{dy}{dx}=12\sin^3(3x)\cos^8(3x)-21\sin^5(3x)\cos^6(3x)$

   v) $\frac{dy}{dx}=18x^2\sec^6\left(x^3\right)\tan^4\left(x^3\right)+9x^2\sec^8\left(x^3\right)\tan^2\left(x^3\right)$

2. a) $dy=\left(3x^2+\frac{1}{x^2}+\frac{1}{x}\right)dx$

   b) $dy=\frac{3}{\sqrt{(x-3)(x+3)^3}}dx$

   c) $dy=\frac{2}{1+4x^2}dx$

   d) $dy=\frac{-\sqrt{3}\csc^2\sqrt{3x}}{2\sqrt{x}}dx$

   e) $dy=\left(2\cos 2x\cos 3x-3\sin 2x\sin 3x\right)dx$

   f) $dy=\frac{1}{\sqrt{e^{2x}-1}}dx$