

Key

Math106, Quiz # 11

1. Name:

ID #:

(Show your work)

$u=4x \quad du=4dx$

Q1 Find $\int 7x^2 \ln(4x) dx$.

(4)

$$I = \frac{7}{64} \int \underbrace{(4x)^2}_{u^2} \ln \underbrace{4x}_u \underbrace{4dx}_{du}$$

$$= \frac{7}{64} \left[\frac{u^3 \ln u}{3} - \frac{u^3}{9} \right] + C$$

$$= \frac{7}{64} \left[\frac{(4x)^3 \ln 4x}{3} - \frac{(4x)^3}{9} \right] + C$$

40. $\int \frac{e^{au} du}{u^n} = -\frac{e^{au}}{(n-1)u^{n-1}} + \frac{a}{n-1} \int \frac{e^{au} du}{u^{n-1}}, \quad n \neq 1$

41. $\int \ln u du = u \ln u - u + C$

42. $\int u^n \ln u du = \frac{u^{n+1} \ln u}{n+1} - \frac{u^{n+1}}{(n+1)^2} + C, \quad n \neq -1$

43. $\int u^n \ln^m u du = \frac{u^{n+1} \ln^m u}{n+1} - \frac{m}{n+1} \int u^n \ln^{m-1} u du, \quad m, n \neq -1$

44. $\int \frac{du}{u \ln u} = \ln |\ln u| + C$

Examine $f(x, y) = x^3 + y^3 - xy$ for relative maxima or minima by using the second-derivative test.

Q2.

$\frac{\partial f}{\partial x} = f_x = 3x^2 - y = 0 \quad \frac{\partial f}{\partial y} = 3y^2 - x = 0$

$(x, y) = (0, 0) \text{ or } (\frac{1}{3}, \frac{1}{3})$

C.P.

$D = f_{xx} \cdot f_{yy} - f_{xy}^2$ (1)

$f_{xx} = 6x$
 $f_{yy} = 6x$ (1)

$D(0, 0) = -1$

$D(\frac{1}{3}, \frac{1}{3}) = 2 \cdot 2 - 1 = 3$

$f_{xy} = -1$

↓
Saddle

min

(1)

(1)