$\bar{x} = 27.8$ Almost 30 min
$m = 23/30$ First @ 16
20 22 25 25 27 29 29 29 29
30 31 33 34 34 36

MATH 131
Quiz 8
November 25, 1997

Name Key

17 students

1. In the following integrals, you may use substitution.

a. $\int_1^4 x^3 + \sqrt{x}\, dx = \int_1^4 x^3 + x^{1/2}\, dx = \frac{x^4}{4} + \frac{x^{3/2}}{3/2}\Big|_1^4$

$= \frac{4^4}{4} + \frac{2}{3}4^{3/2} - \left(\frac{1}{4} + \frac{2}{3}\right) = 64 + \frac{16}{3} - \frac{1}{4} - \frac{2}{3}$

$= 64 - \frac{3}{4} - \frac{1}{4} = 64 - \frac{4}{4} = 63$ $\quad 63\frac{5}{12}$ $\quad \frac{757}{12}$

all but 1

b. $\int_0^2 (2x-3)^3\, dx$

$u = 2x-3$
$du = 2\,dx$

$= \int_{x=0}^{x=2} u^3 \frac{1}{2}\, du$

$= \frac{u^4}{8}\Big|_{x=0}^{x=2} = \frac{(2x-3)^4}{8}\Big|_0^2 = \frac{1}{8} - \frac{81}{8} = -10$

all but 9
(all close)

c. $\int \cos(3x)\, dx$

$u = 3x$
$du = 3\,dx$
$\frac{1}{3}\,du = dx$

$= \int \cos u \left(\frac{1}{3}\right) du = \frac{\sin u}{3} + C$

$= -\frac{1}{8}$

$= \frac{\sin 3x}{3} + C$

d. $\int \sin^2 x \cos x\, dx$

$u = \sin x$
$du = \cos x\, dx$

$= \int u^2\, du = \frac{u^3}{3} + C$

$= \frac{(\sin x)^3}{3} + C$

all but 7

e. $\int \frac{x}{\sqrt{x+1}}\, dx$ [Hint: try u = x+1.]

$u = x+1$
$du = dx$

$\int \frac{u-1}{\sqrt{u}}\, du = \int u^{\frac{1}{2}} - u^{-1/2}\, du = \frac{u^{3/2}}{3/2} - \frac{u^{1/2}}{1/2} + C$

$= \frac{2}{3}(x+1)^{3/2} - 2(x+1)^{1/2} + C$

all but 9
all close

2. True or false: (Give reasons.)

$\int \ln x\, dx = x \ln x - x + C$

$D(x\ln x - x) = x\frac{1}{x} + \ln x - 1 = 1 + \ln x - 1 = \ln x$

True

all but 10
(much work)

3. A force of 10 pounds is required to hold a spring 1 foot beyond its natural length. How much work is done in pulling the spring from rest to 5 feet beyond it natural length?

$F(x) = kx$ (Hooke's law)

$F(1) = 10$

so $10 = k \cdot 1$

$k = 10$

$F(x) = 10x$

$\int_0^5 10x\, dx = \frac{10x^2}{2}\Big|_0^5$

$= 5(25) - 0$

$= 125$ ft-lbs