Math 132 Study Problems for Test 1
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Instructions. There are no special instructions for these practice problems.

1. Do the following integrals. The problems are not ordered by degree of difficulty.

(a) \[ \int \sqrt{3 - 5y} \, dy \]
(b) \[ \int \frac{p}{\sqrt{p^2 + 3}} \, dp \]
(c) \[ \int_0^1 x^2(1 + 2x^3)^5 \, dx \]
(d) \[ \int_0^\pi x \cos(x^2) \, dx \]
(e) \[ \int e^{\cos(x)} \sin(x) \, dx \]
(f) \[ \int (2 - x)^{71} \, dx \]
(g) \[ \int \sqrt{\cot(\theta)} \csc^2(\theta) \, d\theta \]
(h) \[ \int e^{3x} \sqrt{1 + e^{x^2}} \, dx \]
(i) \[ \int x(1 + x)^{70} \, dx \]
(j) \[ \int \frac{1}{x} \tan(\ln x) \, dx \]
(k) \[ \int \frac{x\cos\left(\frac{1+x^2}{\sqrt{1+x^2}}\right)}{x} \, dx \]
(l) \[ \int \frac{d\theta}{\tan(3\theta)} \]
(m) \[ \int_0^{\pi/2} (x + \sin x)^3(1 + \cos x) \, dx \]
(n) \[ \int \frac{dx}{\sqrt{x^2 + 2x + 1}} \]
(o) \[ \int \sin^3 \alpha \cos^3 \alpha \, d\alpha \]

2. p. 285, #38
3. p. 285, #50
4. p. 286, #55
5. p. 286, #60

6. Texas Instruments has set up a production line to manufacture a new calculator. The operations department has determined that the rate of production of these calculators after \( t \) weeks is given by the formula

\[
\frac{dx}{dt} = 5000 \left( 1 - \frac{100}{(t + 10)^2} \right) \text{ calculators/week.}
\]

(Notice that as \( t \) becomes larger, the production approaches 5000 calculators/week. Initially, however the production rate is slower due to the inexperience of the workers assembling the new product. For example, it \( t = 1 \), the production rate is only 868 calculators/week. If \( t = 30 \), the production rate is much higher at 4687 calculators/week.) Find the number of calculators produced from the beginning of the third week to the end of the fourth week.

7. Do the following integrals using substitution or integration by parts (or a combination of both techniques).
(a) $\int z(z - 1)^{1/3}dz$
(b) $\int_{0}^{\pi/4} \cos(2x)\sqrt{4 - \sin(2x)}dx$
(c) $\int \frac{\sin x + \cos x}{\sqrt{\sin x - \cos x}}dx$
(d) $\int x^5 e^x dx$
(e) $\int x \cos(x^2) \sin(x^2)dx$

8. Approximate the value of the definite integral

$$\int_{-1}^{3} \frac{x^3}{\sqrt{x^3 + 4}}dx$$

given that $\int_{-1}^{3} \sqrt{x^3 + 4}dx = 11.21476809$. (Hint: Note that $\frac{x^3}{\sqrt{x^3 + 4}} = \frac{x^2}{\sqrt{x^3 + 4}}x$. Now try integration by parts.)

9. A particle moves along a straight line and has a velocity $v(t) = t^2e^{-t}$ m/sec. after $t$ seconds. What distance does it travel during the first $t$ seconds?