

No calculators, books, notes, etc. are allowed

(70) 1. Evaluate each of the following integrals

(a)  $\int \frac{x^3}{(x^4 + 3)^6} dx$  (5 pts)

(b)  $\int \frac{e^{\arcsin x}}{\sqrt{1-x^2}} dx$  (5 pts)

(c)  $\int x \cos(3x) dx$  (10 pts)

(d)  $\int \arctan(x) dx$  (5 pts)

(e)  $\int \cos(x) 6^{\sin(x)} dx$  (10 pts)

(f)  $\int \frac{\cos x}{\sqrt{3 + \sin x}} dx$  (5 pts)

(g)  $\int \tan^{40}(x) \sec^4(x) dx$  (5 pts)

(h)  $\int \sin^2 \theta d\theta$  (10 pts)

(i) Determine whether or not the following integral converges. If it does, find its value.

$\int_0^1 \ln(x) dx$  (10 pts)

(65) 2. (a) By trigonometric substitution *only*, find

$\int \frac{1+x}{\sqrt{1-x^2}} dx$  (10 pts)

(b) By partial fractions *only*, find

$\int \frac{3x^2 - 4x + 12}{x(x^2 + 4)} dx$  (10 pts)

(c) Find  $y'$  for

i)  $y = (\ln(1+x))^{\sin(x)}$  (5 pts)

ii)  $y = \operatorname{arcsec}(e^x)$  (5 pts)

iii)  $y = x^{\tan(x)}$  (5 pts)

(d) Find  $\lim_{t \rightarrow 0} \frac{\sin(5t)}{\tan(3t)}$  (5 pts)

(e) Find  $\lim_{x \rightarrow 0} (1+x)^{5/x}$  (10 pts)

(f) Use Simpson's rule with  $n = 4$  intervals to approximate  $\int_0^2 x^3 dx$  (10 pts)

(50) 3. (a) By use of the *disk* method, find the volume of the solid generated by rotating the region bounded between  $y = x$  and  $y = x^2$  about the line  $y = -2$ . (15 pts)

(b) By the *shell* method, find the volume of the solid generated by rotating the region bounded by the curves  $y = x$  and  $y = x^4$  about the vertical line  $x = -2$ . (15 pts)

(c) Set up the integral (BUT DO NOT EVALUATE) that gives the length of the curve  $y = \tan(x)$  from  $x = -\pi/4$  to  $x = \pi/4$ . (10 pts)

(c) Set up the integral (BUT DO NOT EVALUATE) that gives the surface area of revolution when the portion of the curve  $y = x^{3/2}$  between  $x = 1$  to  $x = 3$  is rotated about the horizontal line  $y = -3$ . (10 pts)

- (10) 4. Cookies are removed from a 270 degrees oven to cool in a 70 degrees room. After ten minutes, the cookies are 170 degrees. When will they be 120 degrees if the temperature  $T(t)$  satisfies Newton's law of cooling where  $A$  is the temperature of the room.

$$\frac{dT}{dt} = -k(T - A).$$

- (10) 5. Find the Taylor polynomial without remainder for  $f(x) = e^{x-1}$ ,  $a = 1$ ,  $n = 4$ .