

Question 1 [10 points]: Determine

$$\int \frac{1}{x^2 \sqrt{16 - x^2}} dx$$

[10]

Question 2 [10 points]: Determine

$$\int \frac{5x^2 + 3x - 2}{x^2(x+2)} dx$$

[10]

Question 3 [10 points]: Determine the following integrals:

(a) $\int \frac{x}{\sqrt{9+x^2}} dx$

[5]

(b) $\int \frac{1}{x^2+2x+5} dx$

[5]

Question 4 [10 points]:

- (a) Use M_4 , the midpoint rule on four subintervals to approximate

$$\int_0^{4\pi} e^{\cos(x)} \sin^2(x) dx$$

[5]

- (b) Suppose you are using the trapezoid rule on 4 subintervals to approximate $\int_0^4 \sin(x/2) dx$. Determine an error bound $|E_{T_4}|$ on the resulting approximation. (Recall: the error in using the trapezoid rule to approximate $\int_a^b f(x) dx$ using n subintervals is at most $\frac{K(b-a)^3}{12n^2}$ where $|f''(x)| \leq K$ on $[a,b]$.)

[5]

Question 5 [10 points]:

- (a) Evaluate the improper integral $\int_0^{\infty} x^2 e^{-x^3} dx$ making proper use of any required limits.

[5]

- (b) Use the comparison theorem to determine whether $\int_1^{\infty} \frac{\cos^2(x)}{1+x^2} dx$ is convergent or divergent.

[5]