Question 1: Determine $\int_0^{\pi/4} x \sec^2(x)\, dx$

[5]

Question 2: Determine $\int \tan^6(x) \sec^4(x)\, dx$

[5]

Question 3: Determine $\displaystyle\int \frac{\sqrt{4+x^2}}{x^4}\,dx$

[5]

Question 4: Determine $\displaystyle\int \frac{x}{x^2+6x+10}\,dx$

[5]

Question 5: Determine $\int \frac{x+2}{x^2(x-1)}\,dx$

[5]

Question 6: Evaluate $\int_0^{\infty} \frac{1}{(1+x^2)(1+\arctan(x))}\,dx$ making proper use of required limits.

[5]

Question 7: For this question consider the integral

$$\int_0^4 \left(2x^2 - \frac{x^3}{2}\right) dx$$

(i) Determine both T_2 and M_2 (both trapezoid and midpoint rules on two subintervals) and then calculate $(1/3)T_2 + (2/3)M_2$.

[5]

(ii) How many subintervals are required to guarantee that the error in using the midpoint rule is at most $3/4$?

(Recall: the error in using the midpoint rule to approximate $\int_a^b f(x)\,dx$ using n subintervals is at most $\frac{K(b-a)^3}{24n^2}$ where $|f''(x)| \leq K$ on $[a, b]$.)

[5]

Question 8: Determine the area of the region in the first quadrant that is bounded by the curves $y = x^2$, $y = 2 - x$ and the x-axis.

[5]

Question 9: The region in the first quadrant that is bounded by the curves $y = x^2$, $y = 2 - x$ and the x-axis is rotated about the vertical line $x = 3$. Set up BUT DO NOT EVALUATE the integral representing the volume of the resulting solid.

[5]