MA2160 Final Exam - PART 2

Calculators are allowed on Part 2.

Name:(print) _____ ID#: _____

Score - Part 2: ____ / 50

Circle your section number:

Section	Time	Instructor	Section	Time	Instructor
01	08:05	S. Tao	07	11:05	A. Niu
02	12:05	H. Wang	08	12:05	S. Butler
03	09:05	R. Targove	09	14:05	K. Feigl
04	08:05	D. Yorgov	10	15:05	L. Erlebach
05	10:05	A. Roy	11	16:05	L. Erlebach
06	11:05	H. Wang	12	14:05	S. Butler

- Justify all answers and show all work! No work, no credit!

- Frame your answers.

9. (4 pts) Use all the data in the table below to estimate the value of $\displaystyle\int_1^7 f(x)\,dx$ using the Trapezoidal Rule.

x	1	3	5	7
$f(x)$	6	9	11	12

10. (5 pts) Given the differential equation $\dfrac{dy}{dx} = 2x^2 + y$ with the initial condition $y(0) = 1$. Use Euler's method with a step size $\Delta x = 0.2$ to approximate the value of $y(0.4)$. Write your answer in decimal form, carrying at least 3 decimal places.

11. (6 pts) A dam is a rectangular wall that is 1500 feet long and 60 feet high. Find a definite integral that represents the total force of the water on the dam. Assume water comes up to the top of the dam. Water weighs 62.4 lb/ft^3. (**Do not evaluate the integral.**)

12. (5 pts) Find a definite integral that represents the volume of a pyramid whose square base is 2 meters $\times$ 2 meters and whose height is 5 meters. (**Do not evaluate.**)

13. (5 pts) Find a definite integral that represents the volume of the solid obtained by rotating the region bounded by $y = \sqrt{x}$, the $x-$axis and the vertical line $x = 4$ about the line $y = -1$. (**Do not evaluate.**)

14. Let $f(x) = \cos x$.

(a) (4 pts) **Derive** the Taylor series of $f(x)$ near $x = \pi/2$. Write only the first four nonzero terms. Leave no uncomputed derivatives in your answer.

(b) (2 pts) Write the general term of the above Taylor series and the starting value of the index.

(c) (2 pts) Approximate $\cos(1.5)$ using the first degree Taylor polynomial of $f(x) = \cos x$ near $x = \pi/2$.

(d) (2 pts) Use part (a) to find the Taylor series of $f(x) = 3 + x^2 \cos(x)$ near $x = \pi/2$. Write only the first four nonzero terms.

15. Hydrocodone bitartrate is used as a cough suppressant. After the drug is fully absorbed, the quantity of drug in the body decreases at a rate proportional to the amount left in the body. The half-life of hydrocodone bitartrate in the body is 3.8 hours, and the oral dose is 10 mg.

(a) (2 pts) Write a differential equation for the quantity, Q, of hydrocodone bitartrate in the body t hours after the drug was fully absorbed.

(b) (3 pts) Solve the differential equation given in part (a).

(c) (3 pts) Use the half-life to find the constant of proportionality in the differential equation.

16. Consider the points $P = (1, 4, 1)$, $Q = (2, 0, -1)$ and $R = (0, -1, 3)$.

    (a) (2 pts) Find the displacement vectors $\vec{PQ}$ and $\vec{PR}$.

    (b) (5 pts) Find an equation for the plane that contains P, Q and R. Write the equation in the form $ax + by + cz = d$.