Instructions

No notes, no books, no calculators, no cell phones, no pagers, no electronic devices of any kind.

Show all of your work. Circle your answer.

Name_____

Circle your section number below.
Hand in to your TA.

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Section
Number
 321  7:45  Zhao, Jie
 332  9:55  McMahon, Kayla
 322  8:50  Zhao, Jie
 328  1:20  Emrah, Elnur
 331  9:55  Kim, Yoosik
 324 11:00  McMahon, Kayla
 325 12:05  Wang, Kejia
 326 12:05  Emrah, Elnur
 327  1:20  Wang, Kejia
 330  2:25  Kim, Yoosik
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Problem	Points	Score
1	12	
2	12	
3	12	
4	12	
5	12	
6	12	
7	12	
8	12	
9	12	
10	12	
11	12	
12	12	
13	6	
Total	150	

Solutions will be posted shortly after the exam:
www.math.wisc.edu/∼miller

1. (12 pts) Find

$$\int x\sqrt{1+x^2}\,dx$$

2. (12 pts) Find

$$\int x^2 e^x \, dx$$

3. (12 pts) Find

$$\int \frac{1+x^3}{x(1+x)}\ dx$$

4. (12 pts) Use the degree 1 Taylor polynomial for the appropriately chosen function to estimate the value of $\sqrt{9.1}$. Find an upper bound for the absolute value of the error $|\epsilon|$.

5. (12 pts) Find the general solution of

$$\frac{dy}{dx} = 1 + y^2$$

6. (12 pts) Find the general solution of

$$\frac{dy^2}{dx^2} + 2\frac{dy}{dx} + y = x + 1$$

7. (12 pts)

   - $||\vec{a}|| = 5$
   - $||\vec{b}|| = 6$, and
   - $||\vec{a} - \vec{b}|| = 7$.

   What is the dot product: $\vec{a} \cdot \vec{b}$?

8. (12 pts) Find the area of the triangle ABC with corner points:

   - $A = (1, 2, 0)$
   - $B = (2, 3, 1)$
   - $C = (1, 5, 4)$

9. (12 pts) Find the angle θ at the corner B in the triangle ABC with corner points:

- $A = (1, 2, 0)$
- $B = (2, 3, 1)$
- $C = (1, 5, 4)$

10. (12 pts) Sketch the curve

$$\vec{x}(t) = (2 + \cos t)\,\vec{i} \;+\; (3 + \sin t)\,\vec{j}$$

11. (12 pts) Find the parametric equation $\vec{L}(t) = \vec{a} + t\vec{b}$ for the tangent line to the curve:

$$\vec{\rho}(t) = (t+1)\,\vec{i} \;+\; (t^3)\,\vec{j} \;+\; (t^2)\,\vec{k}$$

at $t = 1$.

12. (12 pts) Find the length of the curve

$$\vec{\gamma}(t) = (\cos t)\,\vec{i} \;+\; (t^{\frac{3}{2}})\,\vec{j} \;+\; (\sin t)\,\vec{k}$$

for $0 \leq t \leq 1$.

13. (6 pts) Circle T or F for True or False. No penalty for guessing.
True means that the equation holds for all three dimensional vectors.

T F $\vec{b} \times \vec{a} = -(\vec{a} \times \vec{b})$

T F $\vec{b} \cdot \vec{a} = \vec{a} \cdot \vec{b}$

T F $\vec{a} \cdot (\vec{b} + \vec{c}) = (\vec{a} \cdot \vec{b}) + (\vec{a} \cdot \vec{c})$

T F $\vec{a} \times (\vec{b} + \vec{c}) = (\vec{a} \times \vec{b}) + (\vec{a} \times \vec{c})$

T F $(\vec{a} + \vec{b}) + \vec{c} = \vec{a} + (\vec{b} + \vec{c})$

T F $(\vec{a} \times \vec{b}) \times \vec{c} = \vec{a} \times (\vec{b} \times \vec{c})$

Answers

1. $\frac{1}{2}(1+x^2)^{\frac{3}{2}}+C$
2. $x^2e^x-2xe^x+2e^x+C$
3. $\ln|x|+\frac{x^2}{2}-x+C$
4. $\sqrt{9.1}\approx\frac{181}{60}\quad|\epsilon|\leq\frac{1}{21600}$
5. $y=\tan(x+C)$
6. $y=(x-1)+(C_1+C_2\,x)\,e^{-x}$
7. 6
8. $\frac{1}{2}\sqrt{26}$
9. $\arccos(\frac{-4}{\sqrt{42}})$
10. This a circle of radius one centered at $(2,3)$.
11. $\vec{L}(t)=\begin{pmatrix}2\\1\\1\end{pmatrix}+t\begin{pmatrix}1\\3\\2\end{pmatrix}$
12. $\frac{8}{27}((\frac{13}{4})^{\frac{3}{2}}-1)$
13. The last one is False.