Name _____ Sec_____

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MATH 152 Honors FINAL EXAM Spring 2012

Sections 201-202 P. Yasskin

1-15	/60
16	/12
17	/12
18	/12
19	/12
Total	/108

Multiple Choice: (15 problems, 4 points each)

1. Compute $\int_1^e 9x^2 \ln x \, dx$

a. $2e^3 + 1$
b. $2e^3 - 2$
c. $2e^3$
d. $3e^3 - 3e^2$
e. $3e^3 - 3e^2 + 3$

2. Compute $\int_1^2 \frac{1}{(x-2)^{4/3}} \, dx$

a. $-\infty$
b. -3
c. -1
d. 3
e. ∞

3. Find the arclength of the parametric curve $x = t^4$ $y = \frac{1}{2}t^6$ for $0 \le t \le 1$.

a. $\frac{61}{54}$
b. $\frac{16}{9}$
c. $\frac{11}{9}$
d. $\frac{1}{9}$
e. $\frac{1}{54}$

4. A 2 meter bar has linear density $\rho = 1 + x^3$ kg/m where x is measured from one end. Find the average density of the bar.

a. 2 kg/m
b. 3 kg/m
c. 4.5 kg/m
d. 5 kg/m
e. 6 kg/m

5. A 2 meter bar has linear density $\rho = 1 + x^3$ kg/m where x is measured from one end. Find the center of mass of the bar.

a. $\frac{5}{7}$ m
b. $\frac{5}{6}$ m
c. $\frac{6}{5}$ m
d. $\frac{7}{5}$ m
e. $\frac{42}{5}$ m

6. If $y(x)$ satisfies the differential equation $\frac{dy}{dx} = \frac{x}{y}$ and the initial condition $y(0) = 3$, find $y(4)$.

a. 1
b. 2
c. 3
d. 4
e. 5

7. Find an integrating factor for the differential equation $\frac{dy}{dx} = 2xy + \sin x$.

a. $e^{-\cos x}$
b. $e^{-\sin x}$
c. $e^{\cos x}$
d. e^{x^2}
e. e^{-x^2}

8. A sequence is defined recursively by: $a_1 = 4$ and $a_{n+1} = \sqrt{10a_n - 16}$. Find $\lim_{n\to\infty} a_n$.

a. 2
b. 4
c. 6
d. 8
e. Diverges

9. $\sum_{n=2}^{\infty} \frac{3^n}{2^{2n-1}} =$

a. 2
b. $\frac{9}{14}$
c. $\frac{9}{2}$
d. 4
e. Diverges

10. Find the radius of convergence of the series $\sum_{n=1}^{\infty} \frac{2^n}{(n+1)^2}(x-3)^n$.

a. 0
b. $\frac{1}{3}$
c. $\frac{1}{2}$
d. 2
e. 3

11. $\lim_{x\to 0} \frac{\sin x - x\cos x}{x^3} =$

a. $\frac{1}{6}$
b. $\frac{1}{3}$
c. $\frac{1}{2}$
d. $\frac{2}{3}$
e. ∞

12. Suppose the series $\sum_{n=1}^{\infty} n e^{(-n^2)}$ is approximated by its 9^{th} partial sum $\sum_{n=1}^{9} n e^{(-n^2)}$.
Use an integral to bound the error in this approximation.

a. $\frac{1}{2}e^{-64}$
b. $\frac{1}{2}e^{-81}$
c. $\frac{1}{2}e^{-100}$
d. $\frac{1}{2}e^{-121}$
e. $\frac{1}{2}e^{-144}$

13. Find the angle between the vectors $\vec{u} = \langle 1, 1, -1 \rangle$ and $\vec{v} = \langle 1, -2, -1 \rangle$.

a. $0°$
b. $30°$
c. $45°$
d. $60°$
e. $90°$

14. If $\vec{u}$ points South-West and $\vec{v}$ points Up, which way does $\vec{u} \times \vec{v}$ point?

a. South-East
b. North-East
c. North-West
d. $45°$ Up from North-West
e. $45°$ Down from North-West

15. Find a unit vector perpendicular to both $\vec{a} = (3, -2, 1)$ and $\vec{b} = (-1, 0, 1)$.

a. $(-2, -4, -2)$
b. $(-2, 4, -2)$
c. $(1, -2, 1)$
d. $\left(\frac{1}{\sqrt{6}}, \frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}} \right)$
e. $\left(\frac{1}{\sqrt{6}}, \frac{-2}{\sqrt{6}}, \frac{1}{\sqrt{6}} \right)$

Work Out (4 questions, 12 points each)

Show all you work.

16. Compute $\int_2^4 \frac{8}{x^3\sqrt{x^2-4}}\,dx$

17. The curve $y = x^2$ is rotated about the y-axis to form a bowl. If the bowl contains 8π cm^3 of water, what is the height of the water in the bowl?

18. A leaking sandbag is lifted 20 ft at 2 ft/sec. The sandbag starts out weighing 50 lb but is leaking sand at 3 lb/sec. How much work is done to lift the sandbag?
HINT: What is the weight of the bag when it is y ft above the ground?

19. Determine if the series $\sum_{n=0}^{\infty} \frac{(-1)^n 2^n}{n!}$ converges absolutely, converges but not absolutely or diverges.
If it converges, find the sum. If it diverges, does it diverge to $+\infty$, $-\infty$ or neither?

Circle One: Converges Absolutely Converges Conditionally Diverges

Fill in the Blank: Converges to _____

Or Circle One: Diverges to $+\infty$ $-\infty$ Neither