

Math 1452 Final Exam Fall 2017

Calculators are not allowed on this exam. Work all questions completely. Show all work as described in class.
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1. Consider the region bounded by $y = x^2$, $y = 4$, and the y -axis. **Set up** (but do not solve) integrals to find
 - (a) The volume of the solid generated by rotating this region about the x -axis using washers.
 - (b) The volume of the solid generated by rotating this region about the line $x = 5$ using shells.
2. Graph $r = 3(1 - \sin(\theta))$ and **set up** an integral to find the area enclosed by the graph.
3. A spring whose natural length is 2 ft exerts a force of 100 lb when stretched to a length of 2.25 ft. **Set up** an integral to find the work done in stretching the spring 1 ft beyond its natural length.

4. Evaluate the following integrals.

(a) $\int x e^{3x} dx$

(b) $\int \frac{1}{\sqrt{4+x^2}} dx$

(c) $\int \frac{4x-3}{(x+2)(x-3)} dx$

(d) $\int \sin^2(3x) dx$

5. Indicate if the following series converge or diverge. You must identify all the tests you use and show all the work needed to apply them.

(a) $\sum_{k=1}^{\infty} \frac{3}{2^k}$

(b) $\sum_{k=3}^{\infty} \frac{k}{\ln k}$

(c) $\sum_{k=0}^{\infty} \frac{(k+2)!}{(2k)!}$

(d) $\sum_{k=2}^{\infty} \frac{2+\sqrt{k}}{k}$

6. Find all values of x so that $\sum_{k=1}^{\infty} \frac{1}{\sqrt{k} 3^k} (x-7)^k$ converges

7. If $a_k > 0$ and $a_{k+1} = 3a_k$ for all $k > 1$, does $\sum_{k=1}^{\infty} a_k$ converge? Why or why not?

8. Find the first 3 terms of the Taylor series for $f(x) = \sqrt{x+2}$ centered at $x = 7$.

9. Let $\mathbf{u} = \langle 2, 1, 0 \rangle$ and $\mathbf{v} = \langle -3, 0, 4 \rangle$.

(a) Find $\|\mathbf{u} - 2\mathbf{v}\|$.

(b) Find a vector orthogonal to both \mathbf{u} and \mathbf{v} .

(c) Find the cosine of the angle between \mathbf{u} and \mathbf{v} .