

Always show work to defend your answer in a logical and organized fashion unless told otherwise.

1. (15 points) Find the interval of convergence for $S = \sum_{n=1}^{\infty} (-1)^n \frac{(x+2)^n}{n^{5/2} 5^n}$.

2. (10 points) Find the radius of convergence for $S = \sum_{n=0}^{\infty} \frac{500n(x-1)^n}{n!}$.

3. (10 points) Find simplified values for the following. Show work or explain how you found your answer.

(a) $e^{-i\pi/3}$

(b) $S = \sum_{n=0}^{\infty} (-1)^n \frac{\left(\frac{\pi}{6}\right)^{2n}}{(2n)!}$

4. $f(x) = \sqrt{x^3 + 3}$ for both parts of this problem.

(a) (10 points) Use derivatives, not substitution, to find the second degree Taylor polynomial of $f(x)$ expanded about $a = 1$.

(b) (5 points) Use your answer from the first part to estimate $I = \int_0^2 \sqrt{x^3 + 3} dx$. Simplify your answer.

5. (10 points) Find an equation for the plane in standard form that contains the points $P = (1, 2, 1)$, $Q = (1, 1, -1)$, and $R = (3, 1, 2)$.
6. (5 points) Find a position function for the line passing through the points $P = (-2, 1, 1)$ and $Q = (4, 3, 4)$. Write your answer as a single vector function.
7. (5 points) Which of the following expressions are **not** defined for vectors \vec{v} , \vec{w} , and \vec{p} . Explain why.
- a) $(\vec{v} \times \vec{w}) \cdot \vec{v} \|\vec{p}\|$ b) $(\vec{v} + 4\vec{w}) \cdot \vec{p}$ c) $\vec{v} \times \vec{w} + (\vec{p} \times \vec{w}) \cdot \vec{v}$
8. (5 points) Find the work done on an object by a force $\vec{F} = 2\hat{i} + \hat{j} + 2\hat{k}$ if the object's displacement is $\vec{d} = \langle 1, 1, 1 \rangle$.

9. Find the following if $\vec{v} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{w} = \langle 1, 0, 1 \rangle$.

(a) (5 points) The projection of \vec{w} onto \vec{v} .

(b) (5 points) $\vec{w}_{\vec{v}\perp}$. This is also known as the perpendicular component of \vec{w} with respect to \vec{v} .

(c) (5 points) The cosine of the angle between \vec{w} and \vec{v} .

(d) (5 points) The unit vector \vec{e} in the opposite direction of \vec{w} .

(e) (5 points) The area of the triangle determined by \vec{w} and \vec{v} .