

General Physics Math Skills Diagnostic Test

1. Given two vectors $\vec{A} = 2\hat{i} + 4\hat{j}$ and $\vec{B} = \hat{i} - 8\hat{j} + 6\hat{k}$, evaluate the following expressions:

iv	$\vec{A} \cdot \vec{B} =$	
v	$\vec{A} \times \vec{B} =$	

2. Find the derivatives of the following functions:

i	$f(x) = 5x^4 - 2x^3 + 7$	$f'(x) =$
ii	$g(z) = z \ln z$	$g'(z) =$
iii	$h(r) = \sin r^3$	$h'(r) =$

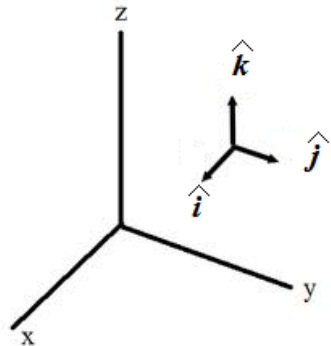
3. For $f(x) = x^3 - 6x^2 + 9x + 2$, find all local extrema by using the first derivative test. Find all the maxima and minima with the second derivative.

4. Compute the following integral:

$\int 2 \sin(x) - 3 \cos(x) dx =$	
$\int \frac{x dx}{3 - 2x^2} =$	
$\int \sin^2 x \cos x dx =$	

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5. In the Cartesian coordinates, we generally use the $(\hat{i}, \hat{j}, \hat{k})$ to represent the three unit vector of a vector. What are the unit-vectors in the cylindrical coordinates and spherical coordinates? Along which direction are they pointing? Use diagram to show your answer.

Cartesian coordinates	Cylindrical coordinates	Spherical coordinates
Unit Vectors: $\hat{i}, \hat{j}, \hat{k}$	Unit Vectors:	Unit Vectors:
Graph: 	Graph:	Graph:

6. Find the solutions for the differential equation: $6x'' + 5x = 0$. Here x'' represents the second derivative of x .