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Name ____

December 15, 2022

Score ____

Show all work to receive full credit. Supply explanations where necessary. Place your final answer in the box provided.

1. (5 points) The points A, B, and C are the vertices of a triangle in space. Find the measure of the angle at B. Write your answer in degrees, rounded to the nearest hundredth.

 $A(0,-3,7), \qquad B(1,-2,3), \qquad C(5,1,-2)$



2. (5 points) A parallelepiped is determined by the vectors $\vec{u} = 3\hat{\imath} - 4\hat{\jmath} + 2\hat{k}$, $\vec{v} = 2\hat{\imath} + \hat{\jmath} - 5\hat{k}$, and $\vec{w} = -3\hat{\imath} + 2\hat{\jmath} - 3\hat{k}$. Find the area of the face that is the parallelogram determined by \vec{u} and \vec{w} .

3.	(5 points) Find sy	mmetric equations for the line through $P(17, 9, -11)$ and $Q(12, -1, -10)$
4.	(5 points) An obj	ect is moved along the graph of
		$\vec{r}(t) = t^2 \hat{\imath} + \cos(\pi t) \hat{\jmath} + \sqrt{t} \hat{k}$
		(0,1,0) to the point $(16,1,2)$. Set up the definite integral that gives path. Use you calculator to approximate the value of the integral.
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5.	(5 points) Ralphie shoots his Red Ryder BB gun from 4ft above the ground across a
•	level field while holding the barrel of his BB gun at an angle of 5° above horizontal.
	Assuming the BB's muzzle velocity is 350 ft/s, how far downrange will the BB travel
	before hitting the ground?



6. (5 points) Find the limit or show that it does not exist:
$$\lim_{(x,y)\to(0,0)} \frac{y^3}{x^2+y^2}$$

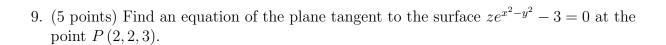
7. (5 points) Find the limit or show that it does not exist:

$$\lim_{(x,y)\to(0,0)} \frac{xy}{x^2 + y^2}$$

8. (5 points) The period, T, of a pendulum of length L is given by

$$T = \frac{2\pi\sqrt{L}}{\sqrt{g}},$$

where g is the acceleration due to gravity. A pendulum is moved from a location where $g=32.09\,\mathrm{ft/s^2}$ to a location where $g=32.23\,\mathrm{ft/s^2}$. There was also a temperature change that resulted in a change in the length of the pendulum from 2.5 ft to 2.48 ft. Use differentials to approximate the corresponding change in the pendulum's period.



10. (5 points) Find the directional derivative of

$$f(x,y,z) = \frac{x}{y} + \frac{y}{z} + \frac{z}{x}$$

at the point (5, -5, 5) in the direction the function decreases most rapidly.

11. (5 points) Let D be the region in the second quadrant bounded by graphs of $y = \frac{1}{2}x^2$, y = 2, and x = 0. Write the double integral as an iterated integral and evaluate.

$$\iint\limits_{D} x^5 \sin(y^4) \, dA$$

12. (5 points) Sketch the region of integration. Then reverse the order of integration and evaluate.

 $\int_0^8 \int_{\sqrt[3]{y}}^2 \frac{y}{x^7 + 1} \, dx \, dy$

13.	(5 points)	Convert th	e iterated	integral	to an	equivalent	integral	in c	ylindrical	coordi-
	nates. DO	NOT EVA	LUATE.							

$$\int_0^3 \int_0^{\sqrt{9-x^2}} \int_{-\sqrt{2x^2+2y^2}}^{6+x^2+y^2} 15z \, dz \, dy \, dx$$

14. (5 points) Evaluate

$$\int_C y \, dx + x^2 \, dy,$$

where C is the parabolic arc along $y = 4x - x^2$ from (4,0) to (1,3).