Instructor: Dr. Rola Alseidi Miss. Amenah Taane	Philadelphia University Faculty/College of Science Department of Basic Science and Mathematics Midterm Exam	Academic Year: 2021/2022. Semester: First. Date: 13/12/2021. Course : Calculus 3. Duration of Exam: 75 minutes.
Name: Student No:		

- The exam consists of **3 pages**. Make sure you have all of them.

1. (12 points) Circle the correct answer

   (a) The equation of the sphere which has $(1,1,2)$ and $(3,1,0)$ as end points of the diameter is

   A. $(x-2)^2+(y-1)^2+(z-1)^2=2$ B. $(x-2)^2+(y-1)^2+(z-1)^2=8$
   C. $(x-2)^2+(y-1)^2+(z-1)^2=\frac{\sqrt{8}}{2}$ D. $(x-2)^2+(y-1)^2+(z+1)^2=2$
   E. $(x-2)^2+(y-1)^2+(z+1)^2=\frac{\sqrt{8}}{2}$

   (b) The cylindrical coordinates of the point $(x,y,x)=(2,2\sqrt{3},-1)$ is

   A. $(4,\frac{\pi}{3},-1)$ B. $(4,\frac{\pi}{6},-1)$ C. $(16,\frac{\pi}{3},-1)$ D. $(16,\frac{\pi}{6},-1)$
   E. $(4,\frac{\pi}{4},1)$

   (c) The domain of the vector valued function $r(t)=2e^t\hat{i}+\frac{3}{t-1}\hat{j}+\sqrt{1-t}\hat{k}$

   A. $(-\infty,1]$ B. $(-\infty,1)$ C. $[1,\infty)$ D. $(1,\infty)$ E. None

(d) The plane $2x + 2y + 2z - 3 = 0$ and the line $x(t) = 1 + t, y(t) = 1 + t, z = 1 + t$ intersect at the point

A. $(2, 2, 2)$ B. $(-2, -2, 2)$ C. $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$ D. $(-2, -2, 2)$
E. None

(e) Let $\vec{u} = \int_1^3 < 2t, 3t^2, 1 > dt$ and $\vec{v} = \lim_{t \to 0} < \frac{\sin(kt)}{t}, \frac{t^2}{t^2 + 1}, 2 >$, then $\vec{u}$ and $\vec{v}$ are perpendicular when $k=$

A. -3 B. -2 C. -1 D. 1 E. 2

(f) If $r(t)$ is a vector valued function , then $\frac{d}{dt}(r(t) \times r'(t))=$

A. $r'(t) \times r''(t)$ B. $r(t) \times r''(t)$ C. $2(r(t) \times r'(t))$ D. $r(t) \times r'(t)$
E. None

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2. (5 points) Find the parametric equations for the line through the points $P_1 = (2, 1, 3)$ and $P_2 = (4, 0, 4)$.

3. (5 points) Find the curvature of the graph $r(t) =< e^t, e^{-t}, 2t >$ at $t = 0$

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4. (4 points) Find the arc length of the graph of $r(t) =< 2\cos t, 2\sin t, \sqrt{5}t > t \in [0, \frac{\pi}{6}]$

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5. (4 points) Find the equation of the plane containing the lines $\ell_1(t) =< 1, 1+t, t >$, $\ell_2 =< 1+t, -t, -1 >$