Question 1

Not yet answered

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Change the integral $\int_0^{\pi}\int_0^2\int_r^2 r^3\,dz\,dr\,d\theta$ **from cylindrical to Cartesian coordinates:**

(A) $\int_{-2}^{2}\int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}}\int_{\sqrt{x^2+y^2}}^{2}\sqrt{x^2+y^2}\;dzdydx$

(B) $\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}}\int_{\sqrt{x^2+y^2}}^{2}(x^2+y^2)dzdydx$

(C) $\int_{-2}^{2}\int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}}\int_{\sqrt{x^2+y^2}}^{2}(x^2+y^2)^{\frac{3}{2}}\,dzdydx$

(D) $\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}}\int_{\sqrt{x^2+y^2}}^{2}(x^2+y^2)^{\frac{3}{2}}\,dzdydx$

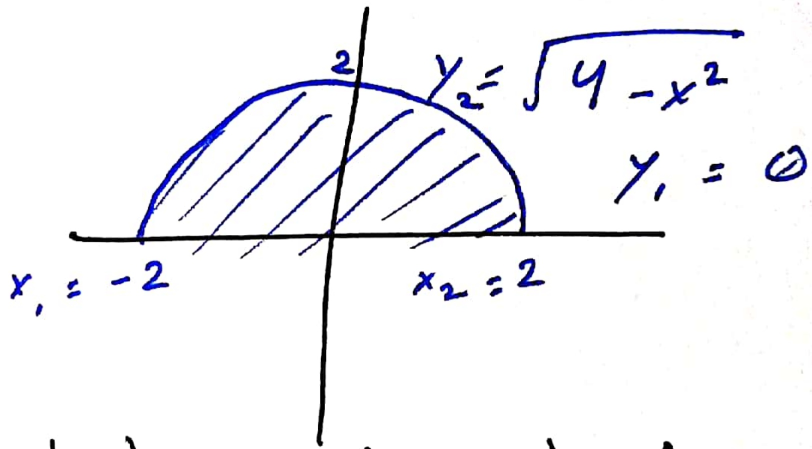
(E) $\int_{-2}^{2}\int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}}\int_{-\sqrt{x^2+y^2}}^{\sqrt{x^2+y^2}}(x^2+y^2)dzdydx$

$z = r, 2 \qquad r = 0, 2 \qquad \theta = 0, \pi$

$z_2 = 2$

$z_1 = r \quad , \quad r^2 = x^2 + y^2$

$z_1 = \sqrt{x^2+y^2}$



$* \ (r)\,(dz\, dr\, d\theta) = dz\, dy\, dx$

$r^3 \longrightarrow (r^2)(r)$

$$\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}}\int_{\sqrt{x^2+y^2}}^{2} (x^2+y^2)\, dz\, dy\, dx$$

B

answered

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Time left 0:45:34

To maximize and minimize $f(x,y) = e^{-xy}$, subject to the constraint $x^2 + 4y^2 = 1$ we need to solve these Lagrange equations:

(A)
$$\begin{aligned} -ye^{-xy} &= 8\lambda y \\ -xe^{-xy} &= 2\lambda x \\ x^2 + 4y^2 &= 1 \end{aligned}$$

(B)
$$\begin{aligned} -ye^{xy} &= 2\lambda x \\ -xe^{xy} &= 8\lambda y \\ x^2 + 4y^2 &= 1 \end{aligned}$$

(C)
$$\begin{aligned} -ye^{-xy} &= 2\lambda x \\ -xe^{-xy} &= 8\lambda y \\ x^2 + 4y^2 &= 1 \end{aligned}$$

(D)
$$\begin{aligned} ye^{-xy} &= 2\lambda x \\ xe^{-xy} &= 8\lambda y \\ x^2 + 4y^2 &= 1 \end{aligned}$$

(E)
$$\begin{aligned} e^{-xy} &= \lambda x^2 \\ e^{-xy} &= 4\lambda y^2 \\ x^2 + 4y^2 &= 1 \end{aligned}$$

○ A

$f(x,y) = e^{-xy}$, $g(x,y) = x^2 + 4y^2 - 1$

$f_x = \lambda g_x$ $\qquad -y e^{-xy} = \lambda (2x)$

$f_y = \lambda g_y$ $\qquad -x e^{-xy} = \lambda (8y)$

$g(x,y) = k$ $\qquad x^2 + 4y^2 = 1$

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Question 5

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The value of this integral $\int_{-2}^{2}\int_{0}^{\sqrt{4-x^2}} \frac{x^2}{x^2+y^2}\, dy dx$ **is:**

(A) $\frac{\pi}{4}$

(B) π

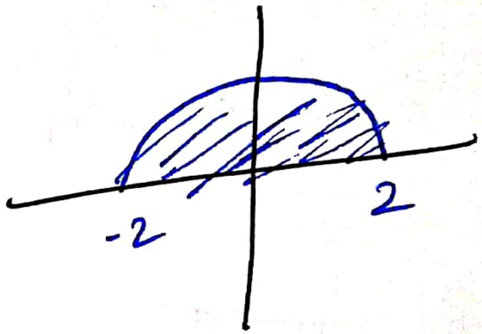
(C) $\frac{\pi}{2}$

(D) 2π

(E) 0

$y = 0 , \sqrt{4-x^2}$ $\quad$ $x = -2, 2$

$$\frac{x^2}{\cancel{x^2+y^2}} \rightarrow \frac{\cancel{r^2}\cos^2\theta}{\cancel{r^2}}$$



$$= \int_0^\pi \int_0^2 \cos^2\theta \; r \, dr \, d\theta$$

$$= \int_0^\pi \frac{\cos^2\theta}{2} \left[r^2 \right]_0^2 \cancel{dr} \, d\theta$$

$$= \int_0^\pi 2\cos^2\theta \, d\theta$$

$$= \pi$$

B

Question 8

Not yet answered

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The equation $\rho^2 = \sec 2\varphi$ **, is:**

(A) a hyperboloid of one sheets.

(B) a hyperboloid of two sheet.

(C) a paraboloid.

(D) a hyperbolic paraboloid.

(E) a cone.

$$\rho^2 = \sec(2\phi)$$

$$\sec(x) = \frac{1}{\cos(x)}$$

$$\rho^2 = \frac{1}{2\cos^2(\phi) - 1}$$

$$\cos(2x) = 2\cos^2(x) - 1$$

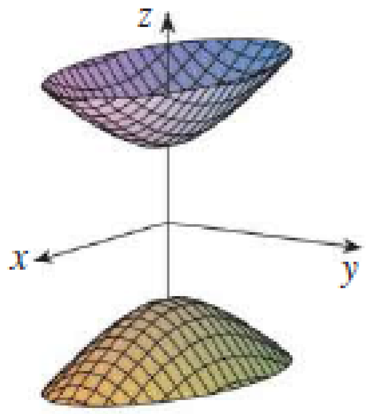
$$\cos(\phi) = \frac{z}{\rho}$$

$$2\,\frac{z^2 \cancel{\rho^2}}{\cancel{\rho^2}} - \rho^2 = 1$$

$$\rho^2 = x^2 + y^2 + z^2$$

$$z^2 - x^2 - y^2 = 1$$

Hyperboloid of Two Sheets



$$-\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

Horizontal traces in $z = k$ are ellipses if $k > c$ or $k < -c$.

Vertical traces are hyperbolas.

The two minus signs indicate two sheets.

Let $f(x,y)=\frac{4x^2\tan^2 y}{x^2+2y^2}$. Then $\lim_{(x,y)\to(0,0)} f(x,y)$

A) does not exist since if (x,y) approaches $(0,0)$ along the line $x=0$ the limit is 0 and if (x,y) approaches $(0,0)$ along the curve $x=y$ the limit is 2.

B) does not exist since $\frac{0}{0}$ is an indeterminate form.

C) exists and equals 0 by using Squeeze Theorem since $0\le\frac{4x^2\tan^2 y}{x^2+2y^2}\le 4\tan^2 y$ and $\lim_{(x,y)\to(0,0)} 4\tan^2 y = 0$.

D) does not exist since if (x,y) approaches $(0,0)$ along the line $x=2$ the limit is 0 and if (x,y) approaches $(0,0)$ along the line $y=3$ the limit is ∞.

E) exists and equals 0 since $f(x,y)$ approaches $(0,0)$ along any line of the form $y=mx$ the limit is 0.

2) let $f(x,y)=\frac{4x^2\tan^2 y}{x^2+2y^2}$, find $\lim_{(x,y)\to 0,0} f(x,y)$

solution:

let $r=x\cos\theta$, $y=r\sin\theta$

$$\lim_{r\to 0}\left[\frac{4(r\cos\theta)^2\tan^2(r\sin\theta)}{r^2\cos^2\theta+2r^2\sin^2\theta}\right]$$

$$=\lim_{r\to 0}\left[\frac{\cancel{r^2}\,4\cos^2\theta\tan^2(r\sin\theta)}{\cancel{r^2}(\cos^2\theta+2\sin^2\theta)}\right]$$

$r=0$ $\Rightarrow \underline{\underline{0}}$ $\boxed{C}$

The volume of the solid region enclosed by the plane $2x + 3y + z = 120$, the cylinder $y = x^2$, and the planes $y = 9$, $z = 0, x = 0$, in the first octant is:

(A) $\int_0^3 \int_{x^2}^9 \int_0^{120+2x+3y} dzdydx$

(B) $\int_0^3 \int_{x^2}^9 \int_0^{120-2x-3y} dzdydx$

(C) $\int_{-3}^3 \int_{x^2}^9 \int_0^{120-2x-3y} dzdydx$

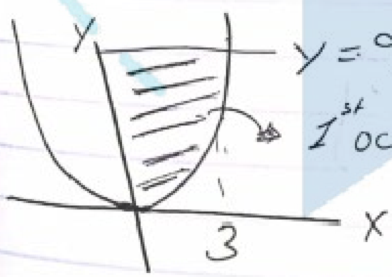
(D) $\int_{-3}^3 \int_9^{x^2} \int_0^{120-2x-3y} dzdydx$

(E) $\int_0^3 \int_{\sqrt{x}}^9 \int_0^{120-2x-3y} dzdydx$

3) $2x + 3y + z = 120$, $y = x^2$, $x = 0$

$y = 9$ $z = 0$

$z = 120 - 2x - 3y$



$$= \int_0^3 \int_{x^2}^9 \int_0^{120-2x-3y} dzdydx$$

$$= \boxed{B}$$

The Directional derivative of the function $f(x, y) = \ln(x^8 + y^8)$ at $(1, -1)$ in the direction of the unit vector that makes an angle $\frac{3\pi}{4}$ with the positive $x-axis$.

A) $2\sqrt{2}$.

B) $-2\sqrt{2}$.

C) $4\sqrt{2}$.

D) $-4\sqrt{2}$.

E) $3\sqrt{2}$.

6) $F(x,y) = \ln(x^8+y^8)$

$\nabla F = \langle \frac{8x^7}{x^8+y^8}, \frac{8y^7}{x^8+y^8} \rangle$

$\nabla F(1,-1) = \langle 4, -4 \rangle$

$\alpha = 3\pi/4$

$\cos^2\alpha + \cos^2\beta = 1$

$\cos^2 3\pi/4 + \cos^2\beta = 1$

$\beta = \pi/4 \;,\; 3\pi/4$

$u = \langle \cos\alpha, \cos\beta \rangle$

$D \cdot d = \langle 4, -4 \rangle \langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle$

$= \frac{-8}{\sqrt{2}} = -4\sqrt{2}$ $\boxed{D}$

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Change the integral

$$\int_{-2}^{2}\int_{-\sqrt{4-x^2}}^{\sqrt{4-x^2}}\int_{\sqrt{3x^2+3y^2}}^{\sqrt{16-x^2-y^2}} \sin\sqrt{x^2+y^2+z^2}\,dzdydx$$

from Cartesian to spherical coordinates:

(A) $\int_0^{\frac{\pi}{6}}\int_0^{2\pi}\int_0^{4} \rho^2 \sin\rho \sin\varphi \, d\rho d\varphi d\theta$

(B) $\int_0^{2\pi}\int_0^{\frac{\pi}{6}}\int_0^{4} \rho^2 \cos\rho \sin\varphi \, d\rho d\varphi d\theta$

(C) $\int_0^{\pi}\int_0^{\frac{\pi}{6}}\int_0^{4} \rho^2 \sin\rho \sin\varphi \, d\rho d\varphi d\theta$

(D) $\int_0^{2\pi}\int_0^{\frac{\pi}{6}}\int_0^{4} \rho^2 \sin\rho \sin\varphi \, d\rho d\varphi d\theta$

(E) $\int_0^{2\pi}\int_0^{\frac{\pi}{3}}\int_0^{4} \rho^2 \sin\rho \sin\varphi \, d\rho d\varphi d\theta$

$X = \pm 2$ $\quad y = \pm\sqrt{4 - x^2}$ $\quad z = \sqrt{3x^2 + 3y^2}$, $\sqrt{16 - x^2 - y^2}$

full circle $\quad$ upper Cone

$z^2 = 16 - x^2 - y^2$

$x^2 + y^2 + z^2 = 16$ $\quad 0 \le \theta \le 2\pi$

$\rho^2 = 16$ $\quad \sin\sqrt{x^2 + y^2 + z^2} = \sin\rho$

$\rho = \pm 4$

$$\int_0^{2\pi}\int_0^{\pi/6}\int_0^{4} \sin\rho\,(\rho^2 \sin\phi)\,d\rho\,d\phi\,d\theta$$

$z = \sqrt{3}\, r$

$\phi = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

$\phi = \pi/6$

D

5

Question 11

Not yet answered

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The point of intersection between the plane $P: x + 2y + 6z = 6$ and the Line $L: x = 8 + 6t,\ y = -2t, z = 1 + t$ is

A) $(2,\ 2, 0)$.

B) $(-4, -4,3)$.

C) $(10, -2, 0)$.

D) $(40, -\ 8, -3)$.

E) $(8,\ 8, -3)$.

① plane : $x+2y+6z=6$

② Line : $x=8+6t$, $y=-2t$, $z=1+t$

Sub ② in ①

$$8+6t+2(-2t)+6(1+t)=6$$

$$t=-1$$

$x=8+6(-1)=\underline{2}$

$y=-2(-1)=\underline{2}$

$z=1-1=\underline{0}$

A

Question 14

Not yet answered

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The curvature of the function $y = \cos 3x$ is

(A) $\dfrac{-9\cos 3x}{(1+9\sin^2 3x)^{\frac{3}{2}}}$

(B) $\dfrac{3|\sin 3x|}{(1+9\cos^2 3x)^{\frac{3}{2}}}$

(C) $\dfrac{9\cos 3x}{(1+9\sin^2 3x)^{\frac{3}{2}}}$

(D) $\dfrac{9|\cos 3x|}{(1+9\sin^2 3x)^{\frac{3}{2}}}$

(E) $\dfrac{9|\cos 3x|}{(1-9\sin^2 3x)^{\frac{3}{2}}}$

$$y = \cos(3x)$$

$$y' = -3\sin(3x)$$

$$y'' = -9\cos(3x)$$

$$K(x) = \frac{|f''(x)|}{\left(1+(f'(x))^2\right)^{3/2}}$$

$$K(x) = \frac{9\,|\cos(3x)|}{\left(1+9\sin^2(3x)\right)^{3/2}}$$

D

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$\int_0^{\ln 3}\int_{e^y}^{3} f(x,y)\,dx\,dy$, when we reverse the order of integration, we will get:

(A) $\int_{e^y}^{3}\int_0^{\ln 3} f(x,y)\,dy\,dx$

(B) $\int_1^{3}\int_0^{\ln x} f(x,y)\,dy\,dx$

(C) $\int_0^{\ln 3}\int_{e^x}^{3} f(x,y)\,dy\,dx$

(D) $\int_1^{3}\int_0^{\ln 3} f(x,y)\,dy\,dx$

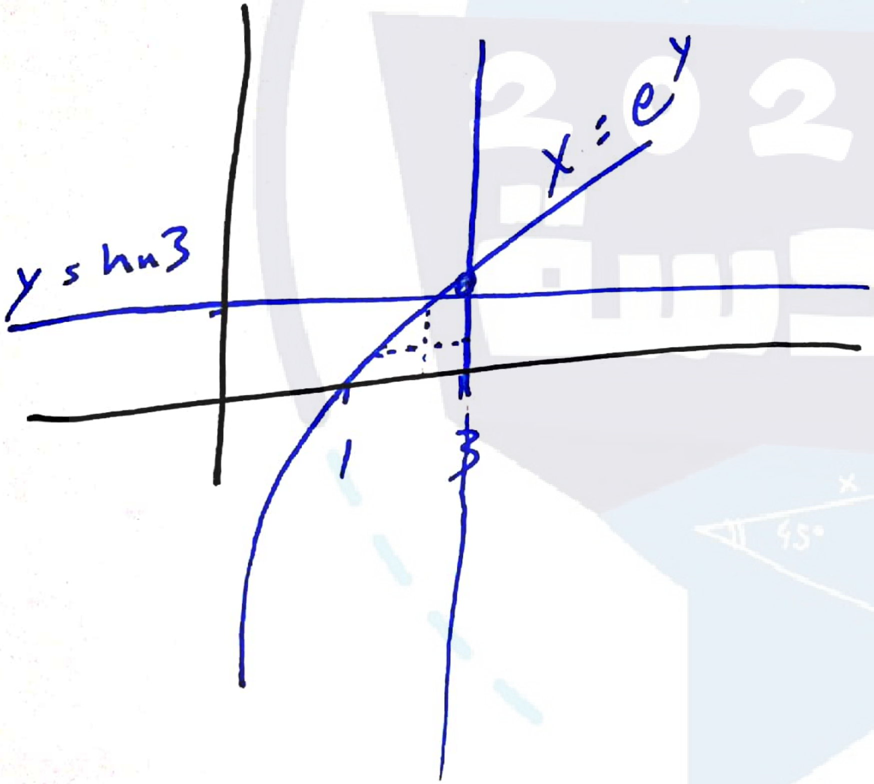
(E) $\int_0^{3}\int_0^{\ln x} f(x,y)\,dy\,dx$

$x = e^y$

$x = 3$

$y = 0$

$y = \ln 3$



$$\int_1^3 \int_0^{\ln x} f(x,y)\,dy\,dx$$

$x = e^y$

$\ln x = y$

B

Not yet answered

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If $x = \frac{y^2 - x\ln z}{z}$, then $\frac{\partial x}{\partial y}$ is:

(A) $\frac{2y}{z - \ln z}$

(B) $-\frac{z + \ln z}{2y}$

(C) $\frac{z + \ln z}{2y}$

(D) $-\frac{2y}{z + \ln z}$

(E) $\frac{2y}{z + \ln z}$

$$x = \frac{y^2 - x\ln z}{z}$$

$$\frac{\partial x}{\partial y} = \frac{2y - \frac{\partial x}{\partial y}(\ln z)}{z}$$

$$\frac{\partial x}{\partial y}(z + \ln z) = 2y$$

$$\frac{\partial x}{\partial y} = \frac{2y}{z + \ln z}$$ E

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To find the shortest distance between the cone $z^2 = x^2 + y^2$ and the point $(-4,1,-2)$ we can use Lagrange multipliers method to solve the following problem:

A) Minimize $f(x,y,z) = (x-4)^2 + (y+1)^2 + (z-2)^2$ subject to the constraint

$$x^2 + y^2 - z^2 = 0.$$

B) Minimize $f(x,y,z) = (x+4)^2 + (y-1)^2 + (z+2)^2$ subject to the constraint

$$x^2 + y^2 - z^2 = 0.$$

C) Minimize $f(x,y,z) = \sqrt{x^2 + y^2 - z^2}$ subject to the constraint

$$(x-4)^2 + (y+1)^2 + (z-2)^2 = 0.$$

D) Maximize $f(x,y,z) = (x+4)^2 + (y-1)^2 + (z+2)^2$ subject to the constraint

$$z^2 = x^2 + y^2$$

E) Minimize $f(x,y,z) = \sqrt{x^2 + y^2 - z^2}$ subject to the constraint

$$(x+4)^2 + (y-1)^2 + (z+2)^2 = 0.$$

○ A

$$(\text{Distance})^2 = (x+4)^2 + (y-1)^2 + (z+2)^2$$

constraint is the point (x, y, z) is on the cone

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If $f(x,y)$ has a continuous second partial derivatives and

$f_x = 2y - 2x^4$, $f_y = 2x - 2y^4$, then

A) f has a saddle point at $(0,0)$ and a local minimum value at $(1,1)$, $(-1,1)$ and $(1,-1)$.

B) f has a saddle point at $(0,0)$ and a local maximum value at $(1,1)$ and $(-1,-1)$.

C) f has a saddle point at $(0,0)$ and a local maximum value at $(1,1)$.

D) f has a local maximum at $(0,0)$ and a local minimum value at $(1,1)$.

E) f has a saddle point at $(1,1)$, a local minimum value at $(0,0)$.

$F_x = 2y - 2x^4$ $\qquad$ $f_y = 2x - 2y^4$ $\qquad$ ~~ex~~

$F_{xx} = -8x^3$ $\qquad$ $F_{yy} = -8y^3$

$F_{xy} = 2$

$F_x = 0$ $\qquad y = x^4 \rightarrow$ $\qquad x = x^{16}$

$F_y = 0$ $\qquad x = y^4$ $\qquad x(1 - x^{15}) = 0$

$x = 0 \;,\; x = 1$

$(0,0) \quad (1,1)$

		f_{xx}	f_{yy}	f_{xy}	$D = (f_{xx})(f_{yy}) - (f_{xy})^2$
~~0,0~~	$(0,0)$	0	0	2	-4
~~1,0~~	$(1,1)$	-8	-8	2	60

$(0,0) \rightarrow$ Saddle

$(1,1) \rightarrow$ local max

c

The equation of the tangent plane to the surface $x^2y^3 + 2xz^3 = 4 + y^4z$ at the point $(-1,1,-1)$ is

A) $-4(x-1) + 5(y+1) + 7(z-1) = 0.$

B) $-4(x-1) + 7(y+1) - 7(z-1) = 0.$

C) $-4(x+1) + 7(y-1) - 3(z+1) = 0.$

D) $-4(x+1) + 7(y-1) - 7(z+1) = 0.$

E) $-4(x-1) + 5(y+1) - 9(z-1) = 0.$

$$x^2y^3 + 2xz^3 = 4 + y^4z$$

$$x^2y^3 + 2xz^3 - y^4z - 4 = 0$$

$$F_x = 2xy^3 + 2z^3$$

$$F_y = 3y^2x^2 - 4y^3z \quad @(-1,1,-1)$$

$$F_z = 6xz^2 - y^4$$

$F_x = -4$

$F_y = 7$

$F_z = -7$

$$-4(x+1) + 7(y-1) - 7(z+1) = 0$$

D

Question 13

Not yet answered

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Let $C_1: \vec{r}_1(t) = \langle 3-t,\ t-2\ ,\ t^2 \rangle$ and C_2: $\vec{r}_2(k) = \langle k,\ 1-k,\ k^2+3 \rangle$ be two curves intersect at the point $P(1,0,4)$. Then the following vector $\vec{\boldsymbol{n}}$ is **perpendicular** to both of the tangent lines of C_1 and C_2 at $P(1,0,4)$.

A) $\vec{\boldsymbol{n}} = \langle 2, 6, -2 \rangle$.

B) $\vec{\boldsymbol{n}} = \langle 6, 6, 0 \rangle$.

C) $\vec{\boldsymbol{n}} = \langle 10, 6, -2 \rangle$.

D) $\vec{\boldsymbol{n}} = \langle -6, 6, 0 \rangle$.

E) $\vec{\boldsymbol{n}} = \langle -8, 8, 0 \rangle$.

$r_1(t) = \langle 3-t, t-2, t^2 \rangle$ @ $(1,0,4)$

$r_1'(t) = \langle -1, 1, 2t \rangle$ $t = 2$

$r_1'(2) = \langle -1, 1, 4 \rangle$

$r_2(k) = \langle k, 1-k, k^2+3 \rangle$ $k = 1$

$r_2'(k) = \langle 1, -1, 2k \rangle$

$r_2'(1) = \langle 1, -1, 2 \rangle$

$r_1'(2) \times r_2'(1) = \langle 6, 6, 0 \rangle$ B