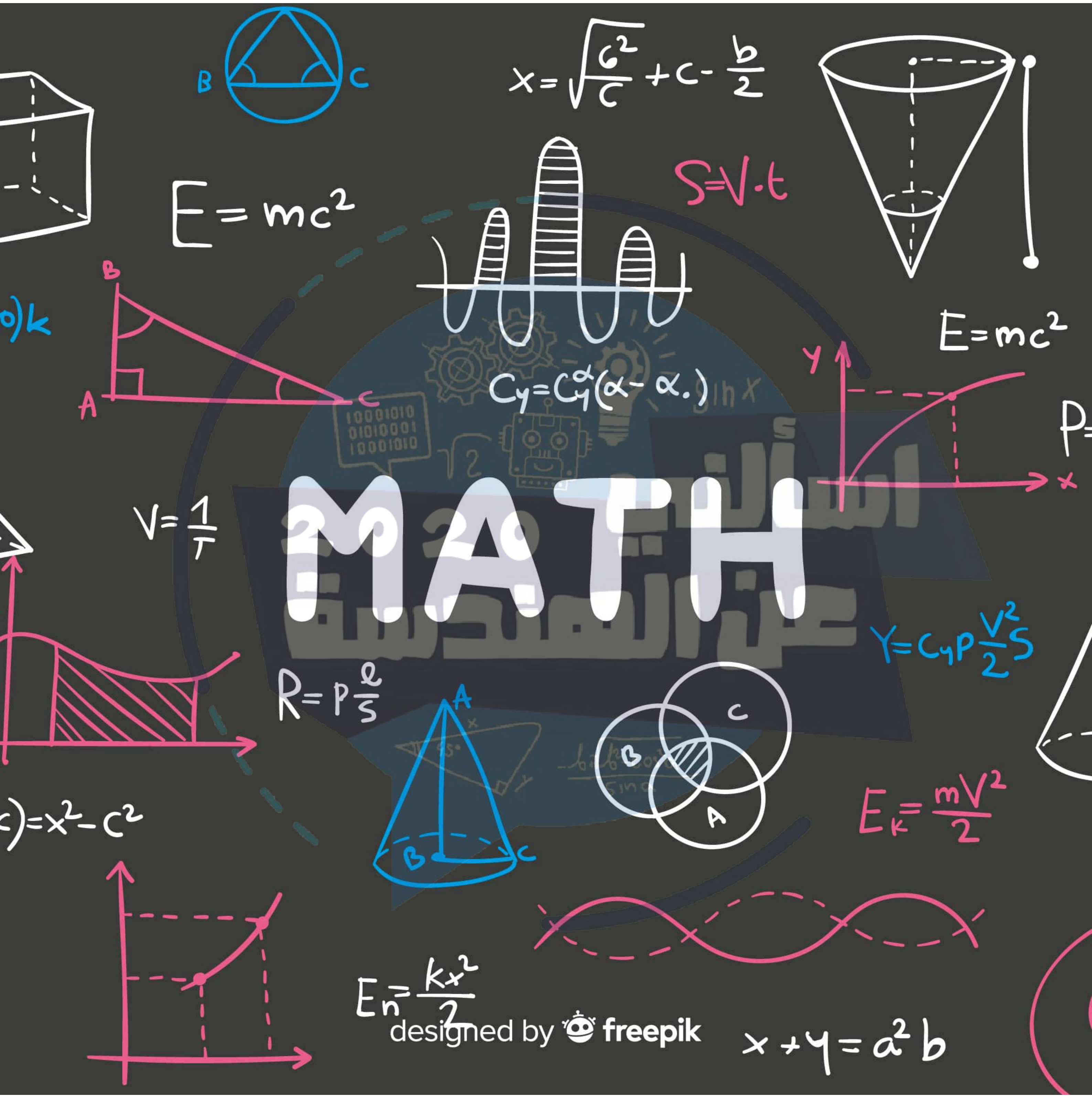


designed by freepik

Section

13.1

$\boxed{1}$

$\ln(t+1)$ | $\frac{t}{\sqrt{9-t^2}}$ | 2^t

$t+1>0$

$t>-1$

$(-1,\infty)$

$\sqrt{9-t^2}>0$

$9>t^2$

$3>|t|$

$- \quad + + \quad -$ on a number line at -3 and 3

$(-3,3)$

R

$D = (-1,\infty) \cap (-3,3) \cap R = (-1,3)$

$\boxed{2}$ $r(t) = \langle \cos t, \ln t, \frac{1}{t-2} \rangle$

Domain $= [-1,1] \cap (0,\infty) \cap R-\{2\}$

$= (0,1]$

$\boxed{4}$

$\langle \lim_{t\to1} \frac{t\cancel{(t-1)}}{\cancel{t-1}}, \lim_{t\to1} \sqrt{t+8}, \lim_{t=1} \frac{\sin \pi t}{\ln t} \rangle$

$\hookrightarrow \frac{0}{0}$ L.R

$\langle 1, 3, -\pi \rangle$

$\frac{\pi \cos \pi t}{\frac{1}{t}} = -\pi$

$\boxed{7}$ <u>Stretch</u> $r(t) = \langle \sin t, t \rangle$

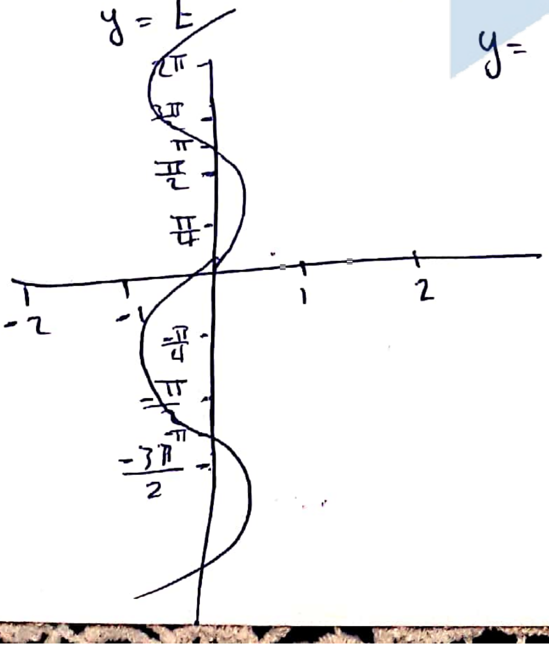
$x = \sin t$

$y = t$

$\longrightarrow$

$x = \sin y$

$y = \sin^{-1}(x)$



$\boxed{9}$ $r(t) = \langle t, 2-t, 2t \rangle$

$x = t$

$y = 2-t$

$z = 2t$

line equation

$\vec{d} = \langle 1, -1, 2 \rangle$

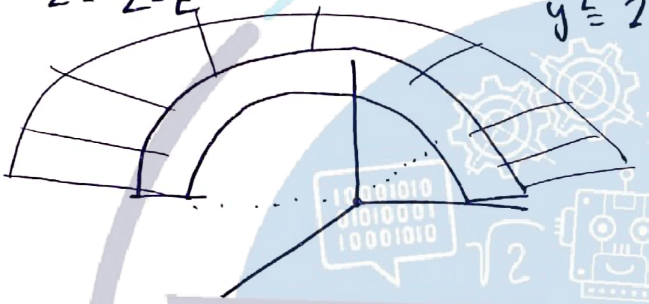
$\boxed{11}$ $r(t) = \langle 3, t, 2-t^2 \rangle$

$x = 3$

$y = t$

$z = 2-t^2$ $\longrightarrow$ $z = 2 - y^2$

$y^2 = 2 - z$



* مش مطلوب الرسم

ركز بالمعادلة

$\boxed{12}$ $r(t) = \langle 2\cos t, 2\sin t, 1 \rangle$

$x = 2\cos t$

$y = 2\sin t$

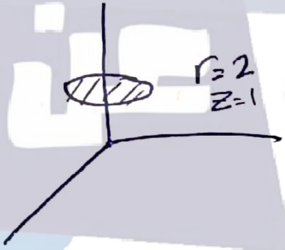
$z = 1$

$\sin^2 t + \cos^2 t = 1$

$\frac{y^2}{4} + \frac{x^2}{4} = 1$

$x^2 + y^2 \, 4$

$z = 1$ Circle



$\boxed{14}$ $r(t) = \langle \cos t, -\cos t, \sin t \rangle$

$x = \cos t$

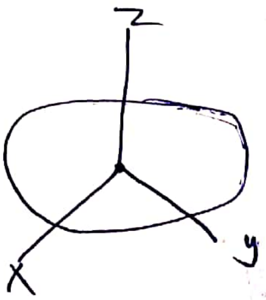
$y = -\cos t$

$z = \sin t$

~~$\sin^2 t + \cos^2 t = 1$~~

~~$z^2 + x^2 = 1$~~

$y = -x$



* الرسم مش مهم

$\boxed{17}$

$P(2,0,0)$

$Q(6,2,-2)$

$\vec{d} = \overrightarrow{PQ} = \langle 4, 2, -2 \rangle$

$x = 2 + 4t$

$y = 2t$

$z = -2t$

$r(t) = \langle 2+4t, 2t, -2t \rangle$

$\boxed{27}$

$x = t\cos t$

$y = t\sin t$

$z = t$

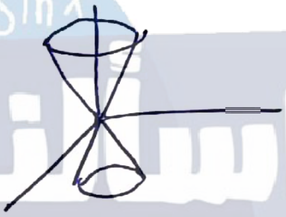
Show that make cone ?

$\sin^2 t + \cos^2 t = 1$

$\frac{y^2}{t^2} + \frac{x^2}{t^2} = 1$

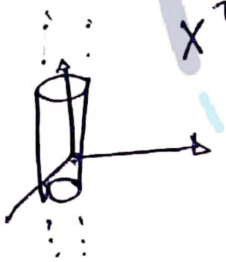
$x^2 + y^2 = t^2$

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



$\boxed{42}$ Graph

$x^2+y^2=4$, $z = xy$



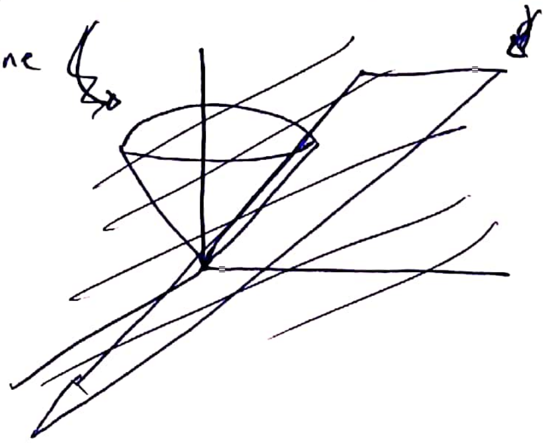
رسمة
صعب

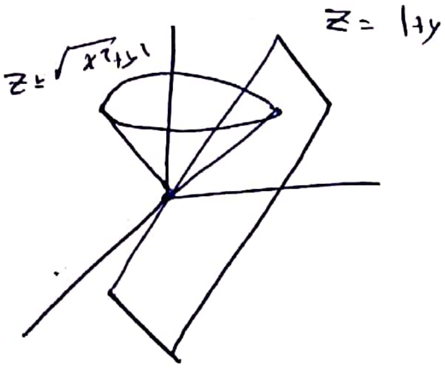
* مش مطلوب
هناك ترسم

$\boxed{43}$ Graph

$z = \sqrt{x^2+y^2}$ $z = 1+y$

upper cone





Section

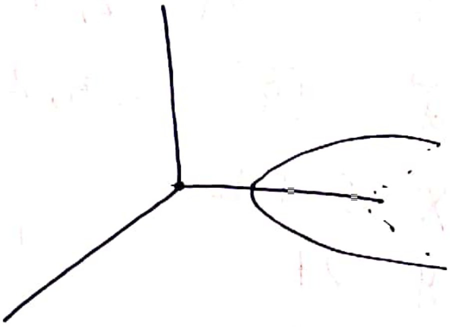
13.2

$\boxed{3}$ $r(t) = \langle t-2, t^2+1 \rangle, \quad t=-1$

a) $x = t-2$

$y = t^2+1$

$y = (x+2)^2+1 \longrightarrow y = x^2+4x+5$



b) $r'(t) = \langle 1, 2t \rangle$

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

$\boxed{6}$ $r(t) = \langle e^t, 2t \rangle, \ t=0$

$x = e^t$

$y = 2t$

$x = e^{\frac{y}{2}}$

$r'(t) = \langle e^t, 2 \rangle$

$r'(0) = \langle 1, 2 \rangle$

$\boxed{9}$ $r(t) = \langle \sqrt{t-2}, 3, \frac{1}{t^2} \rangle$ find $r'(t)$

$r'(t) = \langle \frac{1}{2\sqrt{t-2}}, 0, \frac{-1 \times 2t}{t^4} \rangle$

$r'(t) = \langle \frac{1}{2\sqrt{t-2}}, 0, \frac{-2}{t^3} \rangle$

$\boxed{12}$ $r(t) = \left< \frac{1}{1+t} , \frac{t}{1+t} , \frac{t^2}{1+t} \right>$

$r'(t) = \left< \frac{-1}{(1+t)^2} , \frac{(1+t).1 - t(1)}{(1+t)^2} , \frac{(1+t)2t - t^2(1)}{(1+t)^2}\right.$

$r'(t) = \left< \frac{-1}{(1+t)^2} , \frac{1}{(1+t)^2} , \frac{2t+t^2}{(1+t)^2} \right>$

$\boxed{17}$ find $T(t)$ unit tangent vector

$r(t) = \left< t^2 - 2t , 1+3t , \frac{1}{3}t^3 + \frac{1}{2}t^2 \right> , t=0$

$r'(t) = \left< 2t-2 , 3 , t^2+t \right>$

$r'(0) = \left< -2, 3, 0 \right>$

$T(t) = \frac{r'(0)}{|r'(0)|} = \frac{\left<-2,3,0\right>}{\sqrt{13}} = \left< \frac{-2}{\sqrt{13}} , \frac{3}{\sqrt{13}} , 0 \right>$

$\boxed{19}$ find $T(t)$

~~$r(t) = \left< \sqrt{2}t , e^t , e^{-t} \right>$~~

~~r~~ $r(t) = \left< \cos t , 3t , 2\sin 2t \right> , t=0$

$r'(t) = \left< -\sin t , 3 , 4 \cdot \cos 2t \right>$

$r'(0) = \left< 0 , 3 , 4 \right>$

$T(t) = \frac{r'(0)}{|r'(0)|} = \frac{\left<0,3,4\right>}{5} = \left< 0, \frac{3}{5} , \frac{4}{5} \right>$

$\boxed{24}$ $x = \ln(t+1)$, $y = t\cos 2t$, $z = 2^t$, $(0,0,1)$

Find $r'(t)$

$\ln(t+1) = 0$

$\boxed{t = 0}$

$r(t) = < \ln(t+1) , t\cos 2t, 2^t >$

$r'(t) = < \frac{1}{t+1} , -2t\sin 2t + \cos 2t, 2^t >$

$r'(0) = < 1 , 1 , 1 >$

$x = \frac{1}{t+1}$, $y = \cos 2t - 2t\sin 2t$, $z = 2^t$

$\boxed{25}$ $x = e^{-t}\cos t$, $y = e^{-t}\sin t$, $z = e^{-t}$; $(1,0,1)$

$r(t) = < e^{-t}\cos t, e^{-t}\sin t , e^{-t} >$

$e^{-t} = 1$

$\boxed{t=0}$

~~$r'(t) = <$~~

$r'(t) = < \underbrace{-\sin t e^{-t} - e^{-t}\cos t}_{X}, \underbrace{\cos t e^{-t} - \sin t e^{-t}}_{Y} , \underbrace{-e^{-t}}_{Z} >$

$r'(0) = < 1 , 1 , -1 >$

$\boxed{27}$ $x^2 + y^2 = 25$

$\frac{x^2}{25} + \frac{y^2}{25} = 1$

$z^2 = 20 - y^2$

$z = \sqrt{20 - y^2}$

$x = 5\sin t$

$y = 5\cos t$

$z = \sqrt{20 - 25\cos^2 t}$

$r(t) = < 5\sin t, 5\cos t, \sqrt{20 - 25\cos^2 t} >$

$r'(t) = < 5\cos t, -5\sin t , \frac{50\cos t\sin t}{2\sqrt{20 - 25\cos^2 t}} >$

$\boxed{33}$ $r_1(t) = \langle t, t^2, t^3 \rangle \longrightarrow t=0$

$r_2(t) = \langle \sin t, \sin 2t, t \rangle \longrightarrow t=0$

intersect at $(0,0,0)$

$r_1'(t) = \langle \cancel{t}\, 1, 2t, 3t^2 \rangle$

$r_1'(0) = \langle 1, 0, 0 \rangle \longrightarrow \vec{a}$

$r_2'(t) = \langle \cos t, 2\cos 2t, 1 \rangle$

$r_2'(0) = \langle 1, 2, 1 \rangle \longrightarrow \vec{b}$

$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|.|\vec{b}|} \Rightarrow \frac{1+0+0}{1 * \sqrt{6}} = \frac{1}{\sqrt{6}} \Rightarrow \theta = \cos^{-1}\frac{1}{\sqrt{6}}$

$\boxed{36}$ $\int_1^4 \langle 2t^{\frac{3}{2}}, 0, t^{\frac{3}{2}} + t^{\frac{1}{2}} \rangle$

$= \langle 2t^{\frac{5}{2}} \cdot \frac{2}{5} \Big|_1^4 , 3 , \frac{2}{5} t^{\frac{5}{2}} + \frac{2}{3} t^{\frac{3}{2}} \Big|_1^4 \rangle$

$= \langle \frac{4}{5}(4^{\frac{5}{2}} - 1), 3, \frac{2}{5}(4^{\frac{5}{2}} - 1) + \frac{2}{3}(4^{\frac{3}{2}} - 1) \rangle$ ....

$\boxed{41}$ find $r(t)$

$r'(t) = \langle 2t, 3t^2, \sqrt{t} \rangle$; $r(1) = i + j = \langle 1, 1, 0 \rangle$

$r(t) = \int r'(t) = \langle \underset{+c_1}{t^2}, \underset{+c_2}{t^3}, \underset{+c_3}{\frac{2}{3} t^{\frac{3}{2}}} \rangle$

$r(1) = \langle 1 + c_1, 1 + c_2, \frac{2}{3} + c_3 \rangle = \langle 1, 1, 0 \rangle$

$c_1 = 0, \quad c_2 = 0, \quad c_3 = \frac{-2}{3}$

$r(t) = \langle t^2, t^3, \frac{2}{3} t^{\frac{3}{2}} - \frac{2}{3} \rangle$

$\boxed{53}$

$$\frac{d}{dt}\left[r(t) \times r'(t)\right] = r(t) \times r''(t)$$

$$r(t) \times r''(t) + \underbrace{r''(t) \times r'(t)}_{} \longrightarrow = 0$$

$$r(t) \times r''(t) + 0$$

because $\theta = 0$

$r'(t) \times r'(t) \times \sin\theta$

$= 0$

$$r(t) \times r''(t) \quad \#$$

$\boxed{55}$ $r(t) \neq 0$

Show that:

$$\frac{d}{dt}|r(t)| = \frac{1}{|r(t)|} r(t) \cdot r'(t)$$

$$|r(t)|^2 = r(t) \cdot r(t) \quad \Big) \frac{d}{dt}$$

$$\cancel{2}|r(t)| \frac{d}{dt}|r(t)| = \cancel{2} r(t) r'(t)$$

$$\frac{d}{dt}|r(t)| = \frac{r(t) \cdot r'(t)}{|r(t)|}$$

#

Section

13.3

$\boxed{1}$ $r(t) = \langle 2\cos t, \sqrt{5}t, 2\sin t \rangle \qquad -2 \leq t \leq 2.$

$x = 2\cos t \xrightarrow{1} -2\sin t \xrightarrow{2} 4\sin^2 t.$

$y = \sqrt{5}t \xrightarrow{1} \sqrt{5} \xrightarrow{2} 5$

$z = 2\sin t \xrightarrow{1} 2\cos t \xrightarrow{2} \cancel{4\sin^2 t}\ 4\cos^2 t.$

$$L = \int_{-2}^{2} \sqrt{4(\underbrace{\sin^2 t + \cos^2 t}_{1})+5}\ dt.$$

$$= \int_{-2}^{2} 3\ dt = 3(2+2) = 12.$$

$\boxed{3}$ $r(t) = \sqrt{2}\ t i + e^{t} j + e^{-t} k \qquad 0 \leq t \leq 1$

$x = \sqrt{2}t \xrightarrow{1} \sqrt{2} \xrightarrow{2} 2$

$y = e^{t} \xrightarrow{} e^{t} \xrightarrow{} e^{2t}$

$z = e^{-t} \xrightarrow{1} -e^{-t} \xrightarrow{} e^{-2t}.$

$$L = \int_{0}^{1} \sqrt{\underbrace{e^{2t} + 2 + e^{-2t}}_{\text{مربع كامل}}}\ dt \rightarrow \int_{0}^{1} \sqrt{(e^{t} + e^{-t})^2}\ dt$$

$$= \int_{0}^{1} e^{t} + e^{-t}\ dt. \rightarrow e^{t} - e^{-t}\Big]_{0}^{1}$$

$$= e^{1} - \frac{1}{e} - [1-1]$$

$$= e - \frac{1}{e}.$$

$\boxed{3}$ $r(t) = (5-t)i + (4t-3)j + 3tk$ $P(4,1,3)$

$5-t=4$

$-t=4-5$

$\boxed{t=1}$ ✓

a)

$x = 5-t \xrightarrow{1} -1 \xrightarrow{2} 1$

$y = 4t-3 \xrightarrow{1} 4 \xrightarrow{2} 16$

$z = 3t \xrightarrow{1} 3 \xrightarrow{2} 9$

$L = \int_1^t \sqrt{1+16+9}\,dt = \sqrt{26}(t-1)$

$L = \sqrt{26}(t-1) \rightarrow t = \frac{L}{\sqrt{26}} + 1$

$t-1 = \frac{L}{\sqrt{26}}$

b) $L=4 \rightarrow t = \frac{4}{\sqrt{26}} + 1$

$r = \left(5-\left(\frac{4}{\sqrt{26}}+1\right)\right)i + \left(4\left(\frac{4}{\sqrt{26}}+1\right)-3\right)j + 3\left(\frac{4}{\sqrt{26}}+1\right)k$

$P\left(5-\left(\frac{4}{\sqrt{26}}+1\right), 4\left(\frac{4}{\sqrt{26}}+1\right), 3\left(\frac{4}{\sqrt{26}}+1\right)\right)$

$\underline{4]}$ $r(t) = 12t\,i + 8t^{\frac{3}{2}}\,j + 3t^2\,k \qquad 0 \le t \le 1$

$$x = 12t \xrightarrow{1} 12 \xrightarrow{2} 144$$

$$y = 8t^{\frac{3}{2}} \xrightarrow{1} \frac{3}{\cancel{2}_1} \cdot \overset{4}{\cancel{8}}\, t^{\frac{1}{2}} \xrightarrow{2} 144t$$

$$z = 3t^2 \xrightarrow{1} 6t \xrightarrow{2} 36t^2.$$

$$L = \int_0^1 \sqrt{\underbrace{144 + 144t + 36t^2}_{\text{مربع كامل}}}\, dt \to \int_0^1 \sqrt{(12+6t)^2}\, dt$$

$$L = \int_0^1 12 + 6t \; dt \to 12(1-0) + 3t^2\Big]_0^1$$

$$12 + 3 - 0 = 15$$

$\underline{6]}$ $r(t) = t^2\,i + 9t\,j + 4t^{\frac{3}{2}}\,k \qquad 1 \le t \le 4$

$$x = t^2 \xrightarrow{1} 2t \xrightarrow{2} 4t^2$$

$$y = 9t \xrightarrow{1} 9 \xrightarrow{2} 81$$

$$z = 4t^{\frac{3}{2}} \xrightarrow{1} \frac{3}{\cancel{2}_1} \cdot \overset{2}{\cancel{4}}\, t^{\frac{1}{2}} \xrightarrow{2} 36t$$

$$L = \int_1^4 \sqrt{\underbrace{4t^2 + 36t + 81}_{\text{مربع كامل}}}\, dt \to \int_1^4 \sqrt{(2t+9)^2}\, dt.$$

$$L = \int_1^4 2t + 9 \; dt \to t^2\Big]_1^4 + 9(4-1)$$

$$= 16 - 1 + 27$$

$$15 + 27 = 42.$$

$\boxed{7}$ $r(t) = \langle t, 3\cos t, 3\sin t\rangle$ $|r'(t)| = \sqrt{9+1} = \sqrt{10}$

a) 1. $T = \frac{r'(t)}{|r'(t)|}$

$x = t \xrightarrow{'} 1$

$y = 3\cos t \xrightarrow{'} -3\sin t$

$z = 3\sin t \xrightarrow{'} 3\cos t$

$T = \langle \frac{1}{\sqrt{10}}, \frac{-3\sin t}{\sqrt{10}}, \frac{3\cos t}{\sqrt{10}} \rangle$

a) 2- $N = \frac{T'(t)}{|T'|}$

$x = \frac{1}{\sqrt{10}} \xrightarrow{'} 0$

$y = \frac{-3\sin t}{\sqrt{10}} \xrightarrow{'} \frac{-3\cos t}{\sqrt{10}}$

$z = \frac{3\cos t}{\sqrt{10}} \xrightarrow{'} \frac{-3\sin t}{\sqrt{10}}$

$|T'(t)| = \sqrt{\quad \frac{9}{10}}$

$|T'| = \frac{3}{\sqrt{10}}$

$N = \langle 0, \frac{-3\sqrt{10}\cos t}{3\sqrt{10}}, \frac{-3\sqrt{10}\sin t}{3\sqrt{10}} \rangle$

b. $k = \frac{|r'(t) \times r''(t)|}{|r'(t)|^3}$

$r(t) = \langle t, 3\cos t, 3\sin t\rangle$

$r'(t) = \langle 1, -3\sin t, 3\cos t\rangle$

$r''(t) = \langle 0, -3\cos t, -3\sin t\rangle$

But we

so

u

حيكون الحل ع صفحة

القانونين أكثر مطلوبه

السؤال في الأسفل

$k = \frac{|T'(t)|}{|r'(t)|} \rightarrow k = \frac{\frac{3}{\sqrt{10}}}{\sqrt{10}} \rightarrow \frac{3}{10}$

$\boxed{9}$ $r(t) = \langle \sqrt{2}t, e^{t}, e^{-t} \rangle$.

a.- $T = \dfrac{r'(t)}{|r'(t)|}$

$x = \sqrt{2}t \xrightarrow{'} \sqrt{2}$

$y = e^{t} \xrightarrow{'} e^{t}$

$z = e^{-t} \xrightarrow{'} -e^{-t}$.

$|r'(t)| = \sqrt{e^{2t} + 2 + e^{-2t}}$.

له مربع كامل

$|r'(t)| = e^{t} + e^{-t}$

$= \dfrac{e^{t}}{1} + \dfrac{1}{e^{t}}$.

$T = \dfrac{\sqrt{2}}{\cancel{e^{t}+e^{-t}}}$ $= \dfrac{e^{2t}+1}{e^{t}}$.

$T = \left\langle \dfrac{\sqrt{2}e^{t}}{e^{2t}+1}, \dfrac{e^{2t}}{e^{2t}+1}, \dfrac{-1}{e^{2t}+1} \right\rangle$.

حله لنفس فكرة السؤال $\boxed{17}$ غير انه N ثم

الحل بيكون بتعويض

$\dfrac{T'(t)}{|r'(t)|}$

$\boxed{12}$ $r(t) = ti + tj + (1+t^2)k$.

$k = \dfrac{|r' \times r''|}{|r'|^3}$

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

$r''(t) = \langle 0, 0, 2 \rangle$

$r' \times r'' = \begin{vmatrix} i & j & k \\ 1 & 1 & 2t \\ 0 & 0 & 2 \end{vmatrix}$

$= \langle 2, -2, 0 \rangle$

$= \sqrt{8}$

$r' = \sqrt{2+4t^2}$.

$k = \dfrac{\sqrt{8}}{(2+4t^2)^{\frac{3}{2}}}$.

$\boxed{25}$ $r(t) = \langle t, t^2, t^3 \rangle$ $P(1,1,1)$

$\boxed{t=1}$

$k = \frac{|r' \times r''|}{|r'|^3}$

$r' = \langle 1, 2t, 3t^2 \rangle \rightarrow \langle 1, 2, 3 \rangle$

$r'' = \langle 0, 2, 6t \rangle \rightarrow \langle 0, 2, 6 \rangle$

$k = \frac{\sqrt{76}}{(\sqrt{14})^3}$

$r' \times r'' = \begin{vmatrix} i & j & k \\ 1 & 2 & 3 \\ 0 & 2 & 6 \end{vmatrix}$

$= \langle 6, -6, 2 \rangle$

$\sqrt{36+36+4} = \sqrt{76}$

$|r'| = \sqrt{1+4+9} = \sqrt{14}$

$\boxed{26}$ $y = \cos x$

$y' = -\sin x$

$y'' = -\cos x$

$k = \frac{|y''|}{(1+y'^2)^{\frac{3}{2}}}$

$k = \frac{|-\cos x|}{((1+(-\sin x)^2)^{\frac{3}{2}}}$

$(1+\sin^2 x)^{\frac{3}{2}}$

$= \frac{\cos x}{(\cos^2 x)^{\frac{3}{2}}}$

$= \frac{1}{\cos^2 x}$

$\boxed{3}$ $Y = e^{x}$ $\qquad\qquad$ $Y' = e^{x}$

$\qquad\qquad\qquad\qquad\qquad\qquad$ $Y'' = e^{x}$

ⓐ

$$k = \frac{|y''|}{(1+y'^2)^{\frac{3}{2}}}$$

$$k = \frac{e^{x}}{(1+e^{2x})^{\frac{3}{2}}}$$, have a maximum ? → k'

$$k'f = \frac{(1+e^{2x})^{\frac{3}{2}} \cdot e^{x} - e^{x} \cdot \frac{3}{2}(1+e^{2x})^{\frac{1}{2}} \cdot 2e^{2x}}{(1+e^{2x})^{3}}$$

$$k' = \frac{(1+e^{2x})^{\frac{1}{2}} \cdot e^{x}(1+e^{2x} - 3e^{2x})}{(1+e^{2x})^{3}}$$

$$k' = \frac{\cancel{(1+e^{2x})^{\frac{1}{2}}}(1-2e^{2x})\, e^{x}}{(1+e^{2x})^{\cancel{3}\,\frac{5}{2}}}$$ → نقطه حرجه نعتبرها البسط = صفر

$e^{x} \neq 0$.

$\longrightarrow$ $1 - 2e^{2x} = 0$

$2e^{2x} = 1 \rightarrow e^{2x} = \frac{1}{2}$

$2x = \ln(\frac{1}{2}) \rightarrow x = \frac{1}{2}\ln(\frac{1}{2})$

$\longrightarrow$ $x = \frac{1}{2}\overset{zero}{\cancel{\ln 1}} - \frac{1}{2}\ln 2$

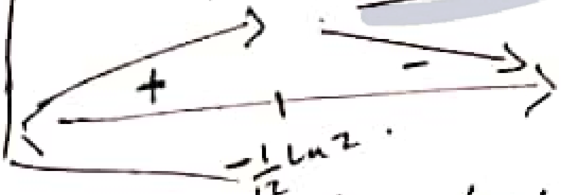
$$x = \boxed{-\frac{1}{2}\ln 2}.$$

ⓑ $\lim_{x\to\infty} k$.

$$\lim_{x\to\infty} \frac{(e^{x})^{\frac{3}{2}\times\frac{2}{3}}}{(1+e^{2x})^{\frac{3}{2}}}$$

$$\lim_{x\to\infty} \left(\frac{e^{\frac{2x}{3}}}{(1+e^{2x})}\right)^{\frac{3}{2}}$$

$$\hookrightarrow \lim_{x\to\infty}\left(\frac{1}{e^{-\frac{2x}{3}} + e^{\frac{4x}{3}}}\right)^{\frac{3}{2}} \rightarrow \lim_{x\to\infty}\left(\frac{1}{0+\infty}\right)^{\frac{3}{2}} = \frac{1}{\infty} = 0$$



↳ local maxima.

$P(-\frac{1}{2}\ln 2, \sqrt{\frac{1}{2}})$

$\boxed{44}$ $$k = \frac{|\dot{x}\ddot{y} - \dot{y}\ddot{x}|}{[\dot{x}^2 + \dot{y}^2]^{\frac{3}{2}}}$$

$\cdot \longrightarrow \prime$

$\cdot\cdot \longrightarrow \prime\prime$

$x = a\cos\omega t,\ y = b\sin\omega t$

$x \rightarrow \dot{x} = -a\omega\sin\omega t,\ \ddot{x} \longrightarrow -a\omega^2\cos\omega t.$

$y \rightarrow \dot{y} = b\omega\cos\omega t,\ \ddot{y} \longrightarrow -b\omega^2\sin\omega t.$

~~$K = \frac{|-a\omega\sin\omega t \times -b\omega^2}{}$~~

$$k = \frac{|-a\omega\sin\omega t \times -b\omega^2\sin\omega t - b\omega\cos\omega t \times -a\omega^2\cos\omega t|}{[(-a\omega\sin\omega t)^2 + (b\omega\cos\omega t)^2]^{\frac{3}{2}}}$$

$$k = \frac{|ab\omega^3\sin^2\omega t + ab\omega^3\cos^2\omega t|}{\cancel{a^2\omega^2\sin\omega t}(a^2\omega^2\sin^2\omega t + b^2\omega^2\cos^2\omega t)^{\frac{3}{2}}}$$

$= \cancel{\tan}$

$$k = \frac{|ab\omega^3(\sin^2\omega t + \cos^2\omega t)|}{(a^2\omega^2\sin^2\omega t + b^2\omega^2\cos^2\omega t)^{\frac{3}{2}}}.$$

$$k = \frac{|ab\omega^3|}{(a^2\omega^2\sin^2\omega t + b^2\omega^2\cos^2\omega t)^{\frac{3}{2}}}.$$

$\boxed{48}$ $r(t) = \langle \cos t, \sin t, \ln(\cos t) \rangle$ $P(1,0,0)$

$\ln \cos t = 0$
$\cos t = 1$
$\boxed{t = \text{zero}}$

$T = \frac{(r')}{|r'|}$, $N = \frac{(T')}{|T'|}$

$B = T \times N$

حله صعب طويل ومكرره .

$\boxed{49}$ equ of Normal plane → ١ـ نجد r'
ثم نجد مشتقة T ، وكالعادة نعوض عن t بالرقم

$\vec{w_1}$ ← $r' \perp$ Normal plane

والمتجه تعرفنا السؤال
تعويض مباشر

equ of Osculating plane

٢ـ نجد N , T ←

$B \neq T \times N$

$B \perp$ Osculating plane

$\vec{w_2}$ ← B

والمتجه نعرفه من السؤال ← والتعويض مباشر