

• $A(4, 0), B(-4, 0)$: $y=0$ $\frac{x^2}{16} - \frac{y^2}{7} = 1$
 $C(a, b)$
 $AP \perp BP$, $P(s, t)$
 $\angle APC = 90^\circ$ CP
 • A, B, C, P CP
 $\angle AOB = 0$ x - AB MO

$M(0, \frac{b+t}{2})$ $x_C = -x_P = -t$
 $R = MA = \sqrt{(0-4)^2 + (\frac{b+t}{2}-0)^2}$
 $x^2 + y^2 - (b+t)y = 16$ $x^2 + (y - \frac{b+t}{2})^2 = 16 + (\frac{b+t}{2})^2$
 $a^2 + b^2 - b(b+t) = 16$ $C(a, b)$
 $a^2 - bt = 16$
 $\frac{a^2 - 16}{t} = b$
 $\frac{(a^2 - 16)^2}{t^2} = b^2$

$$\frac{a^2}{16} - \frac{b^2}{7} = 1 \rightarrow \frac{a^2}{16} - 1 = \frac{b^2}{7} \quad \frac{x^2}{16} - \frac{y^2}{7} = 1 \quad C(a,b)$$

$$\frac{7(a^2 - 16)}{16} = b^2$$

$$\frac{7(a^2 - 16)}{16} = \frac{(a^2 - 16)^2}{t^2} \quad /: (a^2 - 16) \neq 0$$

$$a \neq \pm 4$$

, x - ,

C

$$\frac{7}{16} = \frac{a^2 - 16}{t^2}$$

$$7t^2 = 16a^2 - 256$$

$$7t^2 = 16s^2 - 256 \quad \leftarrow x_c = -x_p = -t$$

$$\boxed{16x^2 - 7y^2 = 256}$$

$$(4, 0), (-4, 0)$$

$$, 16x^2 - 7y^2 = 256 :$$

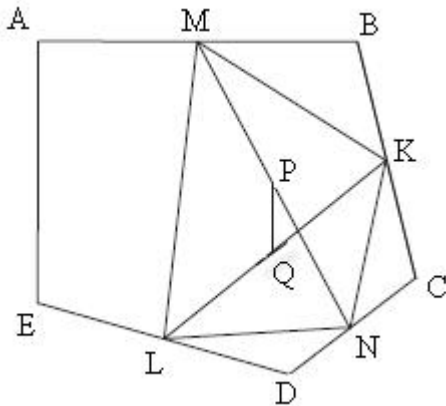
$$16x^2 - 7y^2 = 256 .$$

$$. a = 4, b = \frac{\sqrt{7}}{16}$$

$$, \frac{x^2}{16} - \frac{y^2}{\left(\frac{7}{256}\right)} = 1$$

,

$$((4, 0), (-4, 0)) x -$$



KL Q - , NM P .

$$\vec{LQ} = \vec{QK} \rightarrow \vec{QK} + \vec{QL} = \vec{0}$$

$$\vec{MP} = \vec{PN} \rightarrow \vec{MP} + \vec{NP} = \vec{0}$$

$$+ \begin{cases} \vec{QP} = \vec{QK} + \vec{KM} + \vec{MP} \\ \vec{QP} = \vec{QL} + \vec{LN} + \vec{NP} \end{cases}$$

$$2\vec{QP} = \vec{KM} + \vec{LN}$$

$$\boxed{\vec{QP} = \frac{1}{2}(\vec{KM} + \vec{LN})}$$

$$\vec{KM} = \frac{1}{2}\vec{CA} : \quad \Delta ABC - \quad MK .$$

$$\vec{LN} = \frac{1}{2}\vec{EC} : \quad \Delta ECD - \quad LN$$

$$\vec{EA} = \vec{EC} + \vec{CA}$$

$$\vec{EA} = 2\vec{LN} + 2\vec{KM}$$

$$\vec{EA} = 2(\vec{LN} + \vec{KM})$$

$$\vec{EA} = 4\vec{QP}$$

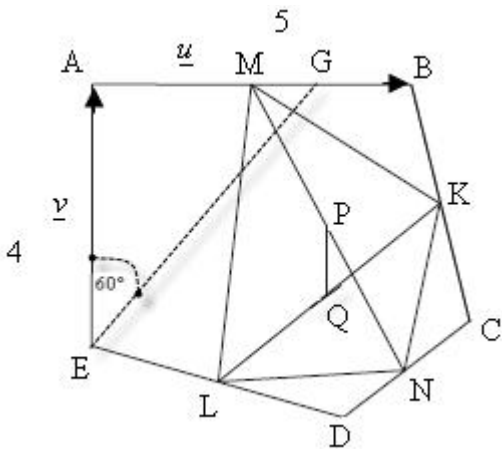
$$|\vec{QP}| = \frac{1}{4}|\vec{EA}|, \vec{QP} \parallel \vec{EA} ::$$

$$|\underline{v}| = 4, |\underline{u}| = 5, \vec{QP} \perp \vec{AB}, (B \quad AB \quad G) t > 0 \quad \vec{AG} = t\underline{u} :$$

$$\angle AEG \quad \vec{QP} \parallel \vec{EA}$$

$$\underline{u} \cdot \underline{v} = 0 \quad \vec{EA} \perp \vec{AB} \quad \vec{QP} \perp \vec{AB}$$

$$|\underline{v}| = 4 \rightarrow \underline{v} \cdot \underline{v} = |\underline{v}|^2 = 16, |\underline{u}| = 5 \rightarrow \underline{u} \cdot \underline{u} = |\underline{u}|^2 = 25$$



$$\cos 60^\circ = \frac{\overline{\text{EG}} \cdot \overline{\text{EA}}}{|\overline{\text{EG}}| |\overline{\text{EA}}|}$$

$$0.5 = \frac{(\overline{\text{EA}} + \overline{\text{AG}}) \cdot \overline{\text{EA}}}{|\overline{\text{EA}} + \overline{\text{AG}}| |\overline{\text{EA}}|} \rightarrow 0.5 = \frac{(\underline{v} + t\underline{u}) \underline{v}}{|\underline{v} + t\underline{u}| |\underline{v}|}$$

$$0.5 = \frac{\underline{v} \cdot \underline{v} + t \underline{v} \cdot \underline{u}}{\sqrt{|\underline{v}|^2 + 2t\underline{v} \cdot \underline{u} + t^2 |\underline{u}|^2} \cdot |\underline{v}|} \rightarrow 0.5 = \frac{16 + 0}{\sqrt{16 + 0 + 25t^2} \cdot 4}$$

$$16 + 25t^2 = 64 \rightarrow t^2 = 1.92 \rightarrow \boxed{t = 1.386} \leftarrow t > 0$$

$$t = 1.386 :$$

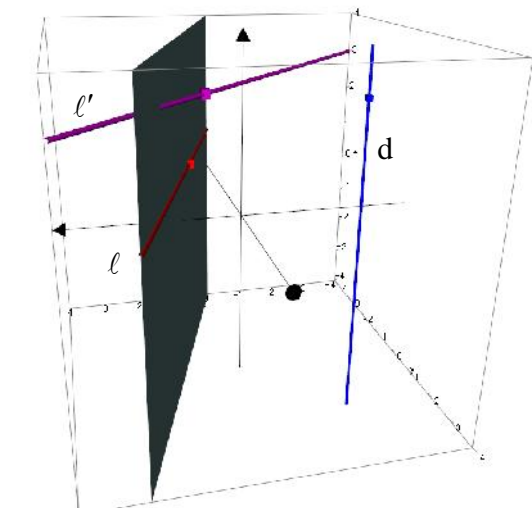
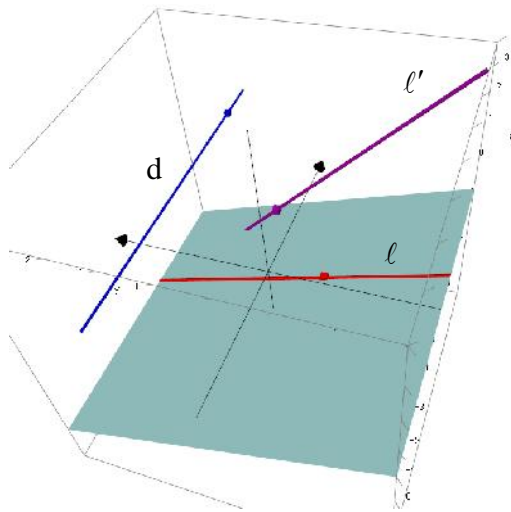
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$$l : (0, 0, 2) + t(1, 1, 0) \quad : l' - l$$

$$l' : (0, 0, -2) + s(1, -1, 0)$$

$$(1, 1, 0) = c(1, -1, 0) \quad c$$

$$(s, -s, -2) : l' \quad - \quad (t, t, 2) : l$$



$$\begin{array}{l}
 \cdot \ell' \quad \ell \quad \underline{d} = (a, b, c) \quad \cdot \\
 \left. \begin{array}{l} (a, b, c) (1, 1, 0) = 0 \rightarrow a + b = 0 \\ (a, b, c) (1, -1, 0) = 0 \rightarrow a + b = 0 \end{array} \right\} a = b = 0 \rightarrow \underline{d} = (0, 0, 1)
 \end{array}$$

$$\begin{array}{l}
 : \quad \quad \quad z - \quad \quad \underline{d} \\
 f : (0, 0, 2) + t(1, 1, 0) + q(0, 0, 1)
 \end{array}$$

$$\left. \begin{array}{l} (a, b, c) (1, 1, 0) = 0 \rightarrow a + b = 0 \\ (a, b, c) (0, 0, 1) = 0 \rightarrow c = 0 \end{array} \right\} a = -b$$

$$f : x - y + d = 0$$

$$0 - 0 + d = 0 \rightarrow d = 0 \quad (0, 0, 2)$$

$$\boxed{f : x - y = 0}$$

$$x - y = 0 :$$

$$y = 1$$

$$(x, 1, z)$$

$$\cdot A(1, 1, 2)$$

$$t = 1 :$$

$$A$$

$$\ell$$

$$\cdot B(-1, 1, -2)$$

$$s = -1 :$$

$$B$$

$$\ell'$$

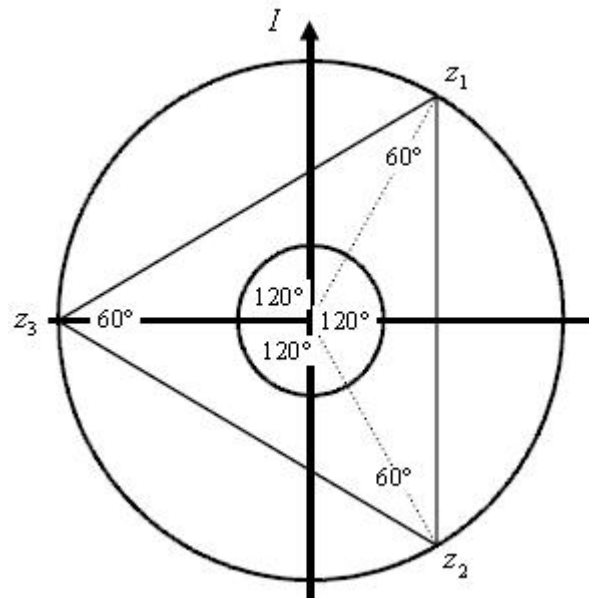
$$\overline{AB} = \underline{B} - \underline{A} = \underline{x} = (-2, 0, -4)$$

$$\cos r = \frac{|(-2, 0, -4) \cdot (1, 1, 0)|}{|(-2, 0, -4)| |(1, 1, 0)|}$$

$$\cos r = \frac{|-2 + 0 + 0|}{\sqrt{4 + 0 + 16} \sqrt{1 + 0 + 1}} = \frac{2}{\sqrt{20} \sqrt{2}}$$

$$\boxed{r = 71.565^\circ}$$

$$71.565^\circ :$$



, z_1, z_2, z_3
 $\cdot 120^\circ$ 60° .

$$z_1 = r (\cos \theta + i \sin \theta) : \quad , z_1 = r \operatorname{cis} \theta$$

$$z_3 = r (\cos (\theta + 120^\circ) + i \sin (\theta + 120^\circ)) : \quad z_3 = r \operatorname{cis} (\theta + 120^\circ) :$$

$$z_2 = r (\cos (\theta + 240^\circ) + i \sin (\theta + 240^\circ)) : \quad z_2 = r \operatorname{cis} (\theta + 240^\circ) :$$

$$\begin{aligned} z_1 + z_2 + z_3 &= \\ &= r [\cos \theta + i \sin \theta + \cos (\theta + 240^\circ) + i \sin (\theta + 240^\circ) + \cos (\theta + 120^\circ) + i \sin (\theta + 120^\circ)] \\ &= r [(\cos \theta + \cos (\theta + 240^\circ) + \cos (\theta + 120^\circ)) + i(\sin \theta + \sin (\theta + 240^\circ) + \sin (\theta + 120^\circ))] \\ &= r [(2 \cos (\theta + 120^\circ) \cos 120^\circ + \cos (\theta + 120^\circ)) + i(2 \sin (\theta + 120^\circ) \cos 120^\circ + \sin (\theta + 120^\circ))] \\ &= r [(\cos (\theta + 120^\circ)(2 \cos 120^\circ + 1) + i(\sin (\theta + 120^\circ)(2 \cos 120^\circ + 1))] \\ &= r [(\cos (\theta + 120^\circ) \cdot 0 + i(\sin (\theta + 120^\circ) \cdot 0)] \\ &= 0 \end{aligned}$$

, (0, 0),

$$z_i = x_i + iy_i$$

$$\left. \begin{aligned} x_0 = \frac{x_1 + x_2 + x_3}{3} \rightarrow 0 = x_1 + x_2 + x_3 \\ y_0 = \frac{y_1 + y_2 + y_3}{3} \rightarrow 0 = y_1 + y_2 + y_3 \end{aligned} \right\} x_1 + iy_1 + x_2 + iy_2 + x_3 + iy_3 = x_1 + x_2 + x_3 + i(y_1 + y_2 + y_3) = 0$$

$$|a - bi - (a + bi)| = 6 \rightarrow |-2bi| = 6 \rightarrow |-bi| = 3 \quad : \quad z = a + bi \quad : \quad |\bar{z} - z| = 6 .$$

$$.b^2 = 9 \rightarrow b = \pm 3 \rightarrow y_{z_1} = 3 \quad z_1 \quad :$$

$$3 = r \sin 60^\circ \rightarrow 3 = r \frac{\sqrt{3}}{2} \rightarrow r = 2\sqrt{3} \quad : \quad \arg z_1 = 60^\circ$$

$$z_2 = \sqrt{3} - 3i \quad b = -3 \quad z_2 \quad - \quad : z_1 = \sqrt{3} + 3i \quad z_1 = 2\sqrt{3} \operatorname{cis}(60^\circ) :$$

$$z_3 = -2\sqrt{3} \quad z_3 = 2\sqrt{3} \operatorname{cis}(60^\circ + 120^\circ) = 2\sqrt{3} \operatorname{cis}(180^\circ)$$

$$z_3 = -2\sqrt{3} \quad , \quad z_2 = \sqrt{3} - 3i \quad , \quad z_1 = \sqrt{3} + 3i \quad :$$

III, II, I

$$h(x) = \ln\left(e^x + \frac{2}{e^x}\right), \quad g(x) = 2e^{-2x}, \quad f(x) = \ln\left(1 + \frac{2}{e^{2x}}\right)$$

$$f(0) = \ln\left(1 + \frac{2}{e^{2 \cdot 0}}\right) = \ln(1 + 2) \rightarrow \boxed{(0, \ln 3)} \quad (1)$$

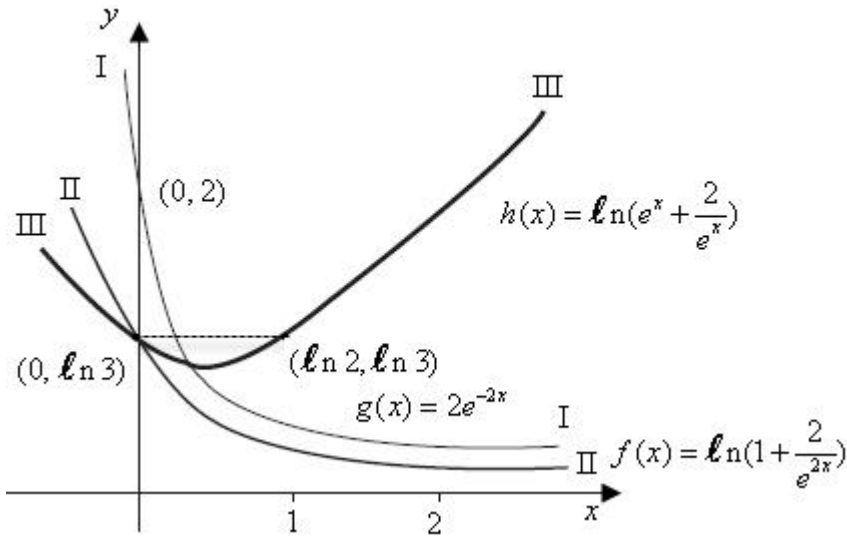
$$g(0) = 2e^{-2 \cdot 0} = 2 \rightarrow \boxed{(0, 2)}$$

$$h(0) = \ln\left(e^0 + \frac{2}{e^0}\right) = \ln(1 + 2) \rightarrow \boxed{(0, \ln 3)}$$

$(0, \ln 3) - h(x)$, $(0, 2) - g(x)$, $(0, \ln 3) - f(x)$:

x -

(2)



$$y = \ln 3$$

$$\ln 3 = \ln\left(e^x + \frac{2}{e^x}\right)$$

$$e^x + \frac{2}{e^x} = 3$$

$$e^{2x} - 3e^x + 2 = 0$$

$$(e^x - 1)(e^x - 2) = 0$$

$$e^x = 2 \rightarrow \boxed{(\ln 2, \ln 3)}$$

$$\begin{aligned} \int_1^2 (h(x) - f(x)) dx &= \int_1^2 \left(\ln\left(e^x + \frac{2}{e^x}\right) - \ln\left(1 + \frac{2}{e^{2x}}\right) \right) dx = \\ &= \int_1^2 \left(\ln \frac{e^x + \frac{2}{e^x}}{1 + \frac{2}{e^{2x}}} \right) dx = \int_1^2 \left(\ln \frac{\frac{e^{2x} + 2}{e^x}}{\frac{e^{2x} + 2}{e^{2x}}} \right) dx = \int_1^2 (\ln e^x) dx = \\ &= \int_1^2 (x) dx = \left. \frac{x^2}{2} \right|_1^2 = 2 - 0.5 = \boxed{1.5} \end{aligned}$$

" 1.5 :

, g(x)

f(x)

1 ≤ x ≤ 2

$$\int_1^2 f(x) dx :$$

$$\int_1^2 (g(x) dx = \int_1^2 (2e^{-2x}) dx = -e^{-2x} \Big|_1^2 = (-e^{-4} + e^{-2}) = -\frac{1}{e^4} + \frac{1}{e^2} = \boxed{\frac{e^2 - 1}{e^4}} .$$

$$\int_1^2 f(x) dx < \frac{e^2 - 1}{e^4} :$$

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