

$$x(6-x) = y(y+8)$$

$$6x - x^2 = y^2 + 8y$$

$$0 = x^2 - 6x + y^2 + 8y$$

$$\boxed{(x-3)^2 + (y+4)^2 = 25}$$

$$.5 \quad , (3, -4) \quad ,$$

:

,

4-

3 ,

$$. x^2 + y^2 = 25$$

$$. \frac{4}{3} \quad -x-$$

.

$$. \left(\frac{3}{4}s, t\right) - ,$$

$$P(s, t)$$

$$\left(\frac{3}{4}s\right)^2 + t^2 = 25$$

$$\frac{9s^2}{16} + t^2 = 25$$

$$\frac{9s^2}{400} + \frac{t^2}{25} = 1$$

$$\boxed{\frac{9x^2}{400} + \frac{y^2}{25} = 1}$$

$$. b^2 = 25 - a^2 = \frac{400}{9} \quad ,$$

/

$$, \left(\frac{4}{3} \cdot 5, 0\right) = \left(6\frac{2}{3}, 0\right)$$

$$, \frac{4}{3} \quad x-$$

$$. a = 6\frac{2}{3} = \sqrt{\frac{400}{9}}, b = 5 - .$$

$$. \frac{9x^2}{400} + \frac{y^2}{25} = 1 \quad , \quad :$$

"

$$b^2 = 25 \cdot a^2 = \frac{400}{9}, \quad \frac{9x^2}{400} + \frac{y^2}{25} = 1 \quad D$$

$$2 \cdot 4.41 = 8.82 \quad FG \quad , c = \sqrt{\frac{400}{9} - 25} = \frac{5\sqrt{7}}{3} \approx 4.41$$

$$, 2a = \quad ,$$

$$DF + DG = 2 \cdot 6 \frac{2}{3} = 13 \frac{1}{3} :$$

$$13 \frac{1}{3} + 8.82 = 22.15 :$$

$$(0, -5) \quad (0, 5) \quad D \quad , y = \quad , \quad FG$$

$$\frac{8.82 \cdot 5}{2} = 22.05 :$$

$$" \quad 22.05 \quad , \quad 22.15 \quad \Delta DFG \quad :$$

$$m, n \quad , |z - n| + |z - m| = \frac{40}{3}$$

$$z = x + yi$$

$$|z - n| + |z - m| = \frac{40}{3}$$

$$|x + yi - n| + |x + yi - m| = \frac{40}{3}$$

$$|(x - n) + yi| + |(x - m) + yi| = \frac{40}{3}$$

$$\sqrt{(x - n)^2 + y^2} + \sqrt{(x - m)^2 + y^2} = \frac{40}{3}$$

$$2a = 2 \cdot 6 \frac{2}{3} = \frac{40}{3}, \quad \frac{9x^2}{400} + \frac{y^2}{25} = 1$$

$$(m = -\frac{5\sqrt{7}}{3} \quad n = \frac{5\sqrt{7}}{3} \quad , \quad (-\frac{5\sqrt{7}}{3}, 0) \quad - \quad (\frac{5\sqrt{7}}{3}, 0) :$$

$$(m = -\frac{5\sqrt{7}}{3} \quad n = \frac{5\sqrt{7}}{3} :$$

$$x^2 + 4y^2 = 36$$

, x -

$$(-6, 0) - (6, 0) \quad x -$$

$$y^2 = 24x$$

$$p = 12, \frac{p}{2} = 6, p > 0 -$$

$$y^2 = 24x \quad :$$

$$(m > 1) \frac{PQ}{QO} = \frac{1}{m} - , OP$$

Q

$$y^2 = 24x$$

P

Q(s, t)

$$M\left(\frac{(m+1)s}{m}, \frac{(m+1)t}{m}\right) \quad P$$

$$(O,)$$

$$y^2 = 24x$$

$$\frac{(m+1)t^2}{m^2} = 24 \frac{(m+1)s}{m} / \frac{m^2}{m+1}$$

$$t^2 = 24 \cdot \frac{ms}{m+1}$$

$$\boxed{y^2 = \frac{24m}{m+1}x}$$

$$y^2 = \frac{24m}{m+1}x \quad , \quad :$$

$$.3\sqrt{3}-4.5$$

$$. \frac{x^2}{36} + \frac{y^2}{9} = 1 \quad , x^2 + 4y^2 = 36$$

$$. (3\sqrt{3}, 0)$$

$$, c = \sqrt{36-9} = 3\sqrt{3}$$

$$. \left(\frac{6m}{m+1}, 0\right)$$

$$, y^2 = \frac{24m}{m+1}x$$

$$. \left| \frac{6m}{m+1} - 3\sqrt{3} \right| = 3\sqrt{3} - 4.5 : \quad , \quad x$$

$$\frac{6m}{m+1} - 3\sqrt{3} = -3\sqrt{3} + 4.5$$

$$\frac{6m}{m+1} = 4.5$$

$$6m = 4.5m + 4.5$$

$$\boxed{m=3} \quad o.k.$$

$$\frac{6m}{m+1} - 3\sqrt{3} = 3\sqrt{3} - 4.5$$

$$\frac{6m}{m+1} = 5.892$$

$$6m = 5.892m + 5.892$$

$$\cancel{m=54.71} \quad \leftarrow -1 < m < 6$$

$$. m = 3 :$$

$$z_3 = z_2, z_1$$

$$z_3 = z_2, z_1$$

$$z_1 = r_1(\cos r + i \sin r)$$

$$z_2 = z_1$$

$$z_2 = r_2(\cos r + i \sin r) : \quad (\quad)$$

$$z_3 = r_3(\cos(r + 180^\circ) + i \sin(r + 180^\circ)) \quad , \quad z_3$$

$$z_2 = z_1 \quad z_3$$

$$, \arg(z_3)$$

$$\cdot \sin(r + 180^\circ) = -\sin r, \cos(r + 180^\circ) = -\cos r :$$

$$\begin{aligned} & (\cos(r + 180^\circ) + i \sin(r + 180^\circ)) = \\ & (-\cos r - i \sin r) = \\ & -(\cos r + i \sin r) \end{aligned}$$

$$\frac{z_1 - z_3}{z_2 - z_3} = \frac{r_1(\cos r + i \sin r) - (r_3(\cos(r + 180^\circ) + i \sin(r + 180^\circ)))}{r_2(\cos r + i \sin r) - (r_3(\cos(r + 180^\circ) + i \sin(r + 180^\circ)))}$$

$$\frac{z_1 - z_3}{z_2 - z_3} = \frac{(\cos r + i \sin r)(r_1 + r_3)}{(\cos r + i \sin r)(r_2 + r_3)}$$

$$\frac{z_1 - z_3}{z_2 - z_3} = \frac{r_1 + r_3}{r_2 + r_3}$$

$$\cdot \frac{r_1 + r_3}{r_2 + r_3} = \frac{z_1 - z_3}{z_2 - z_3} :$$

$$, z_3 = z_1$$

$$\cdot r_1 = r_3$$

$$\cdot (z_1)^7 = (z_3)^7 = -128 \quad (1)$$

, , 7

$$, \operatorname{cis}\left(\frac{360^\circ}{7}\right) = \operatorname{cis}\left(51\frac{3}{7}^\circ\right) ,$$

, , . :
:

$$(z_1)^7 = -128 \rightarrow r_1^7 \operatorname{cis}(7r) = 2^7 \operatorname{cis}(180^\circ + 360^\circ k) \rightarrow r_1 = 2, r = 25\frac{5}{7}^\circ$$

$$(z_3)^7 = -128 \rightarrow -r_3^7 \operatorname{cis}(7r) = -128 \rightarrow r_3^7 \operatorname{cis}(7r) = 2^7 \operatorname{cis}(360^\circ k) \rightarrow r_3 = 2, r = 51\frac{3}{7}^\circ$$

$$\cdot (z_1)^7 = (z_3)^7 = -128 \quad :$$

$$\cdot (z_1)^4 = (z_3)^4 = 64 \quad (2)$$

, , 4

$$, \operatorname{cis}\left(\frac{360^\circ}{4}\right) = \operatorname{cis}(90^\circ) ,$$

$$\cdot x - \sqrt[4]{64} = \sqrt{8} , \quad 64$$

$$\cdot 0^\circ < r < 90^\circ ,$$

$$\cdot (z_1)^4 = (z_3)^4 = 64 \quad :$$

$$, 8 \quad \cdot (z_1)^8 = (z_3)^8 = -8 - 8i\sqrt{3} \quad (3)$$

$$, \operatorname{cis}\left(\frac{360^\circ}{8}\right) = \operatorname{cis}(45^\circ) ,$$

$$4 \cdot 45^\circ = 180^\circ ,$$

$$-8 - 8i\sqrt{3}: \tan[\theta] = \frac{-8\sqrt{3}}{-8} = \sqrt{3} \rightarrow [\theta] = 240^\circ \quad (3rd \text{ quadrant}), R = \sqrt{(-8)^2 + (-8\sqrt{3})^2} = 16$$

$$\left. \begin{aligned} (z_1)^8 = -8 - 8i\sqrt{3} &\rightarrow r_1^8 \operatorname{cis}(8r) = 16 \operatorname{cis}(240^\circ) \rightarrow r_1 = \sqrt{2}, r = 30^\circ \\ (z_3)^8 = -8 - 8i\sqrt{3} &\rightarrow (-r_3)^8 \operatorname{cis}(8r) = 16 \operatorname{cis}(240^\circ) \rightarrow r_3 = \sqrt{2}, r = 30^\circ \end{aligned} \right\} o.k.$$

$$\cdot (z_1)^8 = (z_3)^8 = -8 - 8i\sqrt{3} \quad :$$

$$a_2 = -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i, a_1 = i :$$

$$a_2 = -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i : \tan [= \frac{-0.5\sqrt{2}}{-0.5\sqrt{2}} = 1 \rightarrow [= 225^\circ \text{ (3rd quadrant)}, R = \sqrt{(-\frac{\sqrt{2}}{2})^2 + (-\frac{\sqrt{2}}{2})^2} = 1$$

$$\left. \begin{matrix} a_2 = cis(225^\circ) \\ a_1 = cis(90^\circ) \end{matrix} \right\} q = \frac{cis(225^\circ)}{cis(90^\circ)} \rightarrow \boxed{q = cis(135^\circ)}$$

15 _____

$$a_1 \cdot a_2 \cdot a_2 \cdot \dots \cdot a_{15} = cis(90^\circ) \cdot cis(225^\circ) \cdot cis(360^\circ) \cdot \dots \cdot cis(1980^\circ)$$

$$a_1 \cdot a_2 \cdot a_2 \cdot \dots \cdot a_{15} = cis(90^\circ + 225^\circ + 360^\circ + \dots + 1980^\circ)$$

$$a_1 \cdot a_2 \cdot a_2 \cdot \dots \cdot a_{15} = cis\left[\frac{15(90^\circ + 1980^\circ)}{2}\right]$$

$$a_1 \cdot a_2 \cdot a_2 \cdot \dots \cdot a_{15} = cis(15,525^\circ)$$

$$\boxed{a_1 \cdot a_2 \cdot a_2 \cdot \dots \cdot a_{15} = cis(45^\circ) = \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i} \leftarrow 15,525^\circ - 54 \cdot 360^\circ$$

$$cis(45^\circ) = \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}i$$

15 :

$$a_n = a_1, n$$

$$a_n = a_1$$

$$a_1 q^{n-1} = a_1 \quad /: a_1 \neq 0$$

$$(cis(135^\circ))^{n-1} = 1$$

$$cis(135^\circ(n-1)) = 360^\circ k$$

$$1080^\circ (n-1) = 360^\circ k - 135^\circ$$

$$135^\circ \cdot 8 = 1080$$

$$n-1 = 8$$

$$\boxed{n=9}$$

$$a_n = a_1, n=9 :$$

.2 ABCD

$$a_1 = i \rightarrow A(0,1)$$

$$b a_2 = -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2} \rightarrow B\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$$

$$a_3 = a_1 q^2 = i \operatorname{cis} 270^\circ = i(-i) = 1 \rightarrow C(1,0)$$

() (1)

$$AB = AC = \sqrt{\left(-\frac{\sqrt{2}}{2} - 1\right)^2 + \left(-\frac{\sqrt{2}}{2} - 0\right)^2} = 1.8478 : \quad \Delta ABC$$

$$. x + y - 1 = 0 \quad , AC ,$$

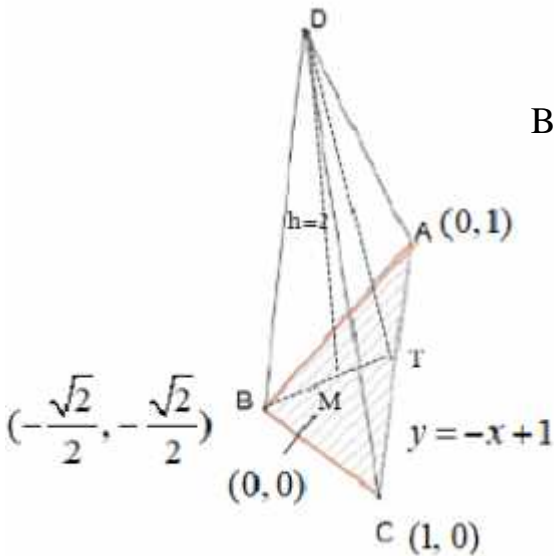
$$BT = \frac{\left| -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2} - 1 \right|}{\sqrt{1^2 + 1^2}} = 1.707$$

$$BC = \sqrt{(1-0)^2 + (0-1)^2} = \sqrt{2}$$

$$S_{\Delta ABC} = \frac{\sqrt{2} \cdot 1.707}{2} = 1.207$$

()

: ΔABC



$$\cos \sphericalangle B = \frac{1.8478^2 + 1.8478^2 - \sqrt{2}^2}{2 \cdot 1.8478 \cdot 1.8478} \rightarrow \sphericalangle B = 45^\circ$$

$$S_{\Delta ABC} = \frac{1.8478 \cdot 1.8478 \cdot \sin 45^\circ}{2} = 1.207$$

()

: ΔABC

$$\frac{\sqrt{2}}{\sin 45^\circ} = 2R \rightarrow \sphericalangle R = 1 \rightarrow M(0,0) \leftarrow MA = MC = MB = 1$$

$$S_{\Delta ABC} = S_{\Delta AMC} = S_{\Delta AMB} = S_{\Delta CMB} = \frac{1 \cdot 1}{2} + \frac{1 \cdot 1 \cdot \sin 135^\circ}{2} + \frac{1 \cdot 1 \cdot \sin 135^\circ}{2} = 1.207$$

$$. V_{ABCD} = \frac{S_{\Delta ABC} \cdot h}{3} = \frac{1.207 \cdot 2}{3} = 0.8047 :$$

. 0.8047 ABCD :

∠DCM , (2)

ΔDCM

$$\tan \angle DCM = \frac{DM}{MC} = \frac{2}{1} \rightarrow \boxed{\angle DCM = 63.43^\circ}$$

63.43° ABC :

ABC ADC (3)

ABC (ΔADC) ,

(AC) ()

AT

ABC ,

BMT

(M - BT ,)

∠DTM ADC

$$MT = BT - BM = BT - R = 1.707 - 1$$

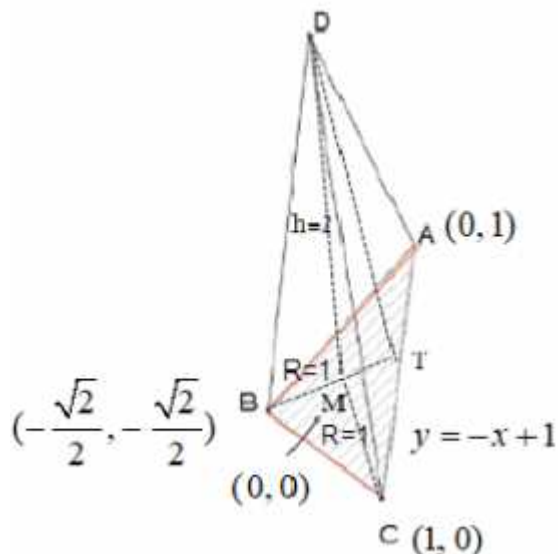
$$\boxed{MT = 0.707}$$

ΔDTM

$$\tan \angle DTM = \frac{DM}{MT} = \frac{2}{0.707}$$

$$\boxed{\angle DTM = 70.53^\circ}$$

70.53° ADC :



$$\cdot x_B = z_B = 0 \quad , y - \quad f_1 : 2x + 3y + 4z - 12 = 0 \quad B \quad .$$

$$\cdot B(0, 4, 0) :$$

$$\cdot x_C = y_C = 0 \quad , z - \quad f_1 : 2x + 3y + 4z - 12 = 0 \quad C$$

$$\cdot C(0, 0, 3) :$$

$$\cdot \boxed{\ell_2 = \underline{x} = (0, 4, 0) + s(0, -4, 3)} : \quad , \overline{BC} = \underline{C} - \underline{B} = \underline{x} = (0, -4, 3)$$

$$\cdot \ell_2 = \underline{x} = (0, 4, 0) + s(0, -4, 3) :$$

$$\cdot \ell_1 = \underline{x} = (5, 8, -12) + t(1, 2, -3) \quad .$$

$$x: 5 + t = 0 \quad \rightarrow t = -5$$

$$y: 8 + 2t = 4 - 4s \quad \rightarrow 4s = -4 - 2(-5) \quad \rightarrow s = 1.5$$

$$z: -12 - 3t = 3s \quad \rightarrow -12 - 3 \cdot (-5) = 3 \cdot 1.5 \quad \rightarrow 3 \neq 4.5$$

$$\cdot \ell_2 = \underline{x} = (0, 4, 0) + s(0, -4, 3) \quad A(1, 0, 0) \quad , f_2 \quad .$$

$$\overline{BA} = \underline{A} - \underline{B} = \underline{x} = (1, -4, 0) \quad , \quad B(0, 4, 0) \quad ,$$

$$\cdot \underline{x} = (0, 4, 0) + s(0, -4, 3) + r(1, -4, 0) : \quad f_2$$

$$(a, b, c) \cdot (0, -4, 3) = 0 \quad \rightarrow -4b + 3c = 0 \quad \rightarrow 3c = 4b \quad \rightarrow b = 3, c = 4$$

$$(a, b, c) \cdot (1, -4, 0) = 0 \quad \rightarrow a - 4b = 0 \quad \rightarrow a = 4 \cdot 3 \quad \rightarrow a = 12$$

$$f_2 : 12x + 3y + 4z + d = 0$$

$$B(0, 4, 0) \quad \rightarrow 3 \cdot 4 + d = 0 \quad \rightarrow d = -12 \quad \rightarrow \boxed{f_2 : 12x + 3y + 4z - 12 = 0}$$

$$\cdot f_2 : 12x + 3y + 4z - 12 = 0 :$$

$$\cdot \ell_3 = \underline{x} = (12, 3, 4) + t(12, 3, 4) \quad \ell_3 = \underline{x} = (12, 3, 4) + t(12, 3, 4) \quad .$$

$$(12, 3, 4)$$

$$\cdot t = (-1) \quad , \quad \ell_3 = \underline{x} = (12, 3, 4) + t(12, 3, 4)$$

:

ABC

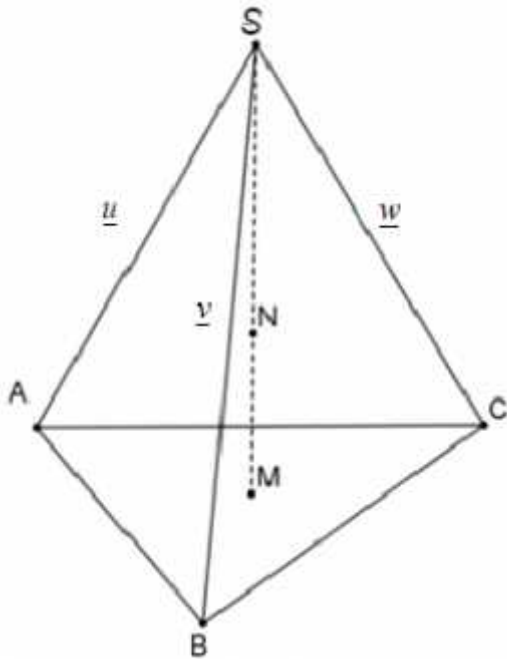
SABC

SM

2:1

BC

T-



$$\boxed{\overrightarrow{SA} = \underline{u}} \quad \boxed{\overrightarrow{SB} = \underline{v}} \quad \boxed{\overrightarrow{SC} = \underline{w}}$$

$$\overrightarrow{SM} = \overrightarrow{SA} + \frac{2}{3}\overrightarrow{AT}$$

$$\overrightarrow{SM} = \overrightarrow{SA} + \frac{2}{3}(\overrightarrow{AS} + \frac{1}{2}(\overrightarrow{SB} + \overrightarrow{SC}))$$

$$\overrightarrow{SM} = \underline{u} + \frac{2}{3}(-\underline{u} + \frac{1}{2}\underline{v} + \frac{1}{2}\underline{w})$$

$$\left. \begin{aligned} \boxed{\overrightarrow{SM} = \frac{1}{3}\underline{u} + \frac{1}{3}\underline{v} + \frac{1}{3}\underline{w}} \\ \boxed{\overrightarrow{SN} = \frac{1}{4}\underline{u} + \frac{1}{4}\underline{v} + \frac{1}{4}\underline{w}} \end{aligned} \right\} \boxed{\overrightarrow{SM} = \frac{4}{3}\overrightarrow{SN}}$$

SM : NM = 3 : 1

SM

N

N - M, S

ABC

SABC (1)

$$\underline{u} \cdot \underline{v} = \underline{u} \cdot \underline{w} = \underline{v} \cdot \underline{w} :$$

$$\overrightarrow{AB} = \overrightarrow{AS} + \overrightarrow{SB} \rightarrow \boxed{\overrightarrow{AB} = -\underline{u} + \underline{v}} \quad (2)$$

$$\overrightarrow{BC} = \overrightarrow{BS} + \overrightarrow{SC} \rightarrow \boxed{\overrightarrow{BC} = -\underline{v} + \underline{w}}$$

$$\overrightarrow{SC} \cdot \overrightarrow{AB} = \underline{w}(-\underline{u} + \underline{v})$$

$$\overrightarrow{SC} \cdot \overrightarrow{AB} = -\underline{u} \cdot \underline{w} + \underline{v} \cdot \underline{w} = 0 \leftarrow \underline{u} \cdot \underline{w} = \underline{v} \cdot \underline{w}$$

$$\boxed{\overrightarrow{SC} \perp \overrightarrow{AB}}$$

$$\overrightarrow{SA} \cdot \overrightarrow{BC} = \underline{u}(-\underline{v} + \underline{w})$$

$$\overrightarrow{SA} \cdot \overrightarrow{BC} = -\underline{u} \cdot \underline{v} + \underline{u} \cdot \underline{w} = 0 \leftarrow \underline{u} \cdot \underline{v} = \underline{u} \cdot \underline{w}$$

$$\boxed{\overrightarrow{SA} \perp \overrightarrow{BC}}$$

$(4\sqrt{3}, 4, 0)$. $C(4\sqrt{3}, 4, 0)$, $\underline{u} = (-4\sqrt{3}, 4, -8)$, $\underline{v} = (0, -8, -8)$, $\underline{w} = (4\sqrt{3}, 4, -8)$:

$\overline{SB} = \underline{v}$

$\underline{B} - (0, 0, 8) = (0, -8, -8)$

$\boxed{B(0, -8, 0)}$

$\overline{SA} = \underline{u}$

$\underline{A} - (0, 0, 8) = (-4\sqrt{3}, 4, -8)$

$\boxed{A(-4\sqrt{3}, 4, 0)}$

$\overline{SC} = \underline{w}$

$(4\sqrt{3}, 4, 0) - \underline{S} = (0, -4, 3)$

$\boxed{S(0, 0, 8)}$

$\overline{SM} = \frac{1}{3}\underline{u} + \frac{1}{3}\underline{v} + \frac{1}{3}\underline{w}$

$\overline{SM} = (0, 0, -8)$

$\underline{M} - (0, 0, 8) = (0, 0, -8)$

$\boxed{M(0, 0, 0)}$

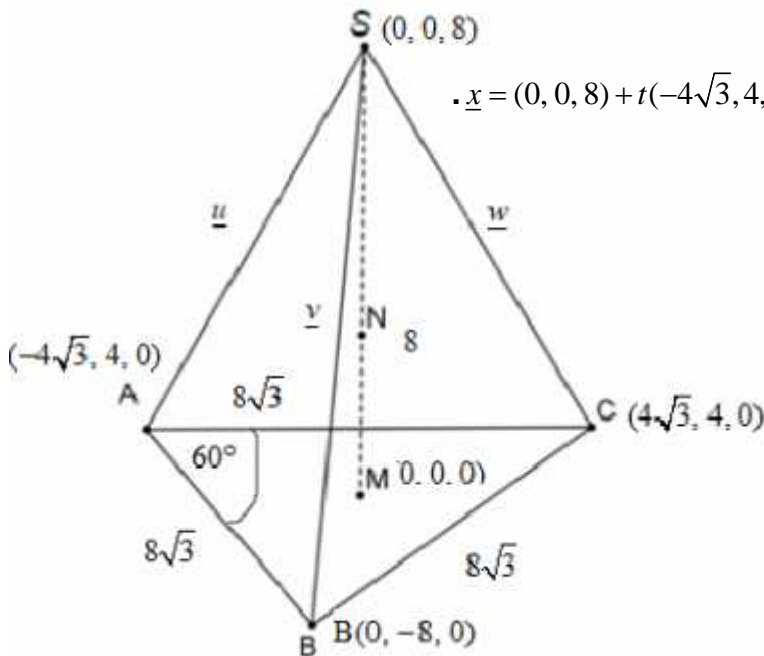
$\left. \begin{aligned} \overline{AB} &= \underline{B} - \underline{A} = \underline{x} = (4\sqrt{3}, -12, 0) \\ |\overline{AB}| &= \sqrt{(4\sqrt{3})^2 + (-12)^2 + 0^2} \\ \boxed{AB} &= 8\sqrt{3} \end{aligned} \right\} S_{\Delta ABC} = \frac{(8\sqrt{3})^2 \sin 60^\circ}{2} \rightarrow \boxed{S_{\Delta ABC} = 48\sqrt{3}}$

$\overline{SM} = \underline{x} = (0, 0, -8)$

$\boxed{SM = 8}$

$V_{SABC} = \frac{48\sqrt{3} \cdot 8}{3} \rightarrow \boxed{V_{SABC} = 128\sqrt{3}}$

$\cdot V_{SABC} = 128\sqrt{3}$,() $M(0, 0, 0)$, $B(0, -8, 0)$, $A(-4\sqrt{3}, 4, 0)$, $S(0, 0, 8)$:



$\cdot \underline{x} = (0, 0, 8) + t(-4\sqrt{3}, 4, -8) + s(0, -8, -8)$:

$\cdot \underline{v} \cdot \underline{u}$ ABS .

$(a, b, c) \cdot (-\sqrt{3}, 1, -2) = 0 \rightarrow -a\sqrt{3} + b - 2c = 0$
 $(a, b, c) \cdot (0, 1, 1) = 0 \rightarrow b + c = 0 \rightarrow c = 1 \rightarrow b = -1$
 $-a\sqrt{3} - 1 - 2 = 0 \rightarrow a = -\sqrt{3}$
 $f_{\Delta ABS} : \sqrt{3}x + y - z + d = 0$
 $S(0, 0, 8) \rightarrow -8 + d = 0 \rightarrow d = 8$
 $\boxed{f_{\Delta ABS} : \sqrt{3}x + y - z + 8 = 0}$

$\cdot \sqrt{3}x + y - z + 8 = 0$ ABS :

"

.($n > 1$), $f(x) = \frac{(\ln(x))^n}{x}$.

.(,) $x > 0$

.() 0 - $\pm\infty$ - $x \rightarrow 0$
 $x = 0$
 x -

$$0 = \frac{(\ln(x))^n}{x}$$

$$\ln(x) = 0$$

$$x = 1 \rightarrow \boxed{(1, 0)}$$

.(1,0) : x - , $x = 0$: , $x > 0$: :
 (1,0) , - , n .
 , " " , ∞ - $x \rightarrow \infty$
 , $y = 0$

$$\boxed{f(x) = \frac{(\ln(x))^n}{x}}$$

$$f'(x) = \frac{n(\ln(x))^{n-1} \cdot x - (\ln(x))^n}{x^2}$$

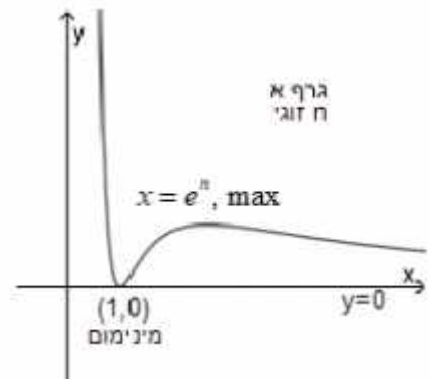
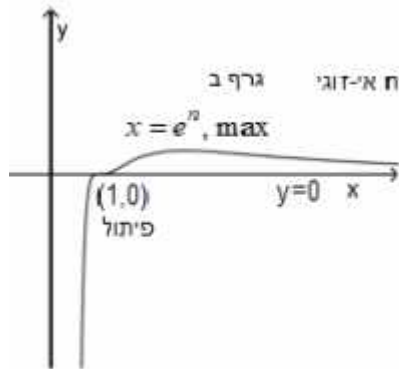
$$\boxed{f'(x) = \frac{(\ln(x))^{n-1}(n - \ln(x))}{x^2}}$$

$$(\ln(x))^{n-1} = 0 \rightarrow \ln(x) = 0 \rightarrow x = 1 \rightarrow \boxed{(1, 0)}$$

$$n - \ln(x) = 0 \rightarrow \ln(x) = n \rightarrow x = e^n, \max$$

(1,0) , - , n
 (1,0) $f(x) \rightarrow -\infty$ - , $x \rightarrow 0$, - n
 , $n-1$ - , - n ,
 (1,0) $(\ln(x))^{n-1}$

- n , n :



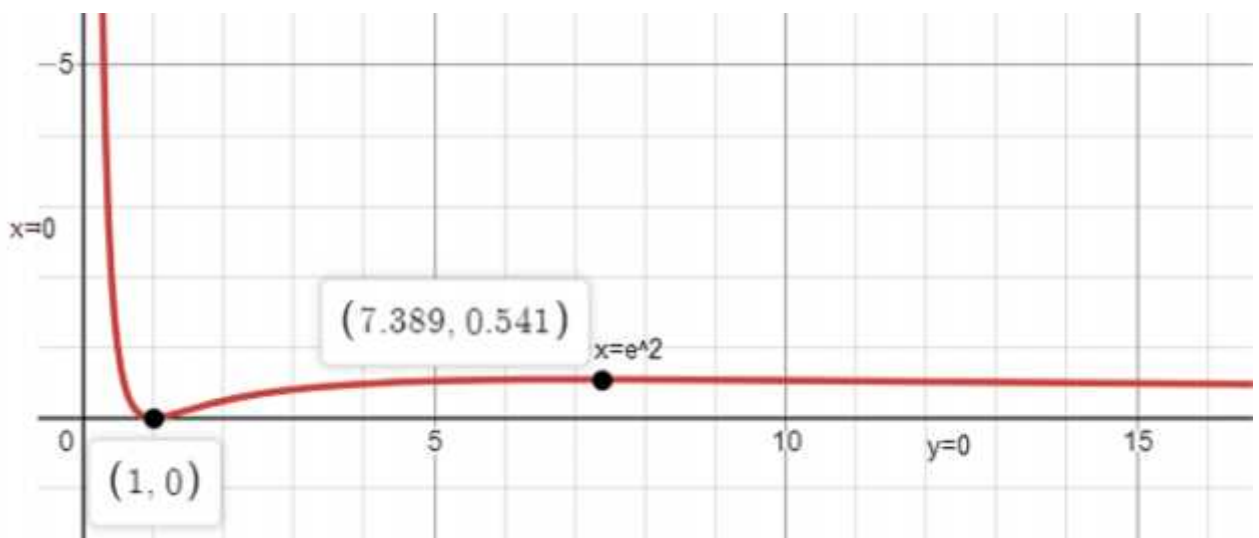
n :
 $-n$

$$l(x) = \frac{(\ln(\frac{1}{x}))^3}{x}, k(x) = \frac{(\ln(\frac{1}{x}))^2}{x}$$

$x > 0$

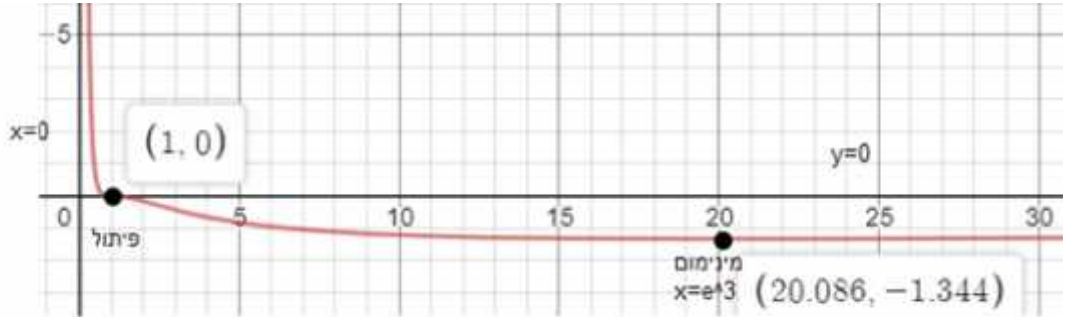
$$\ln\left(\frac{1}{x}\right) = \ln(x^{-1}) = -\ln(x) :$$

$$f(x) = \frac{(\ln(x))^n}{x}, k(x) = \frac{(\ln(\frac{1}{x}))^2}{x} = \frac{(-\ln(x))^2}{x} \rightarrow k(x) = \frac{(\ln(x))^2}{x} :$$



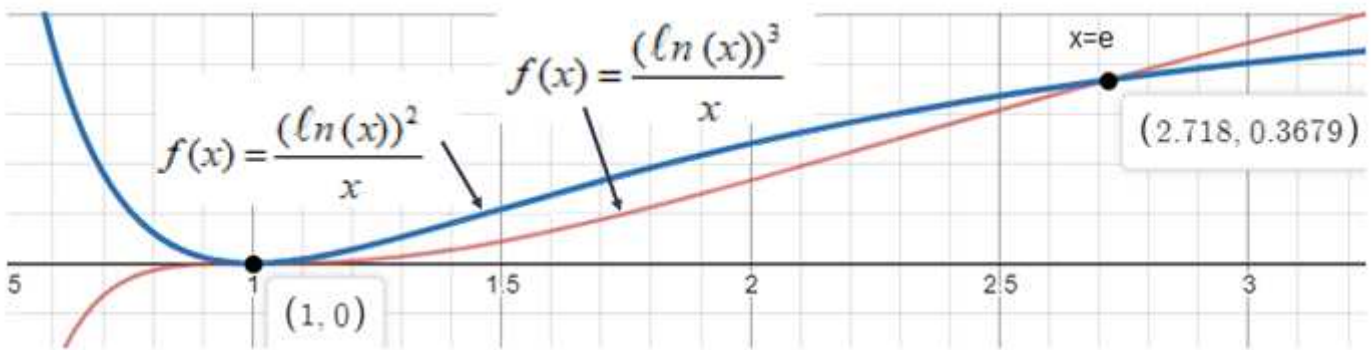
$$l(x) = \frac{(\ln(\frac{1}{x}))^3}{x} = \frac{(-\ln(x))^3}{x} \rightarrow \boxed{l(x) = -\frac{(\ln(x))^3}{x}}$$

$$f(x) = \frac{(\ln(x))^n}{x} \quad (\quad) \quad x -$$



$$h(x) = \frac{(\ln(x-1))^3}{x-1}, \quad g(x) = \frac{(\ln(x-1))^2}{x-1}$$

$$f(x) = \frac{(\ln(x))^3}{x} - (k(x)), \quad f(x) = \frac{(\ln(x))^2}{x} \quad 1$$



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

$$\ln(x) = 0 \rightarrow x = 1$$

$$\ln(x) = 1 \rightarrow x = e$$

$$S = \int_1^e \left(\frac{(\ln(x))^2}{x} - \frac{(\ln(x))^3}{x} \right) dx = \int_1^e \left((\ln(x))^2 \cdot \frac{1}{x} - (\ln(x))^3 \cdot \frac{1}{x} \right) dx$$

$$S = \frac{(\ln(x))^3}{3} - \frac{(\ln(x))^4}{4} \Big|_1^e = \left(\frac{1}{3} - \frac{1}{4} \right) - (0 - 0) = \frac{1}{12}$$

$$\frac{1}{12}$$

$(a > 0), f(x) = \frac{\ln^2 x + a^2}{\ln^2 x - a^2}$

$(x > 0)$ (1)

$\ln^2 x - a^2 \neq 0 \rightarrow \ln^2 x \neq a^2 \rightarrow \ln x \neq \pm a \rightarrow x \neq e^a, e^{-a}$

$x > 0, x \neq e^a, e^{-a}$

$x = e^a, a > 0, x = e^{-a}, x = e^a$

.(

.(0,1) (" ")

$\lim_{x \rightarrow 0^+} \frac{\ln^2 x + a^2}{\ln^2 x - a^2} = \lim_{x \rightarrow 0^+} \frac{\ln^2 x}{\ln^2 x} = 1$

$y = 1$

$\lim_{x \rightarrow +\infty} \frac{\ln^2 x + a^2}{\ln^2 x - a^2} = \lim_{x \rightarrow +\infty} \frac{\ln^2 x}{\ln^2 x} = 1$

$y = 1$

$x = e^{-a}, x = e^a$

,A (2)

$$f(x) = \frac{\ln^2 x + a^2}{\ln^2 x - a^2}$$

$$f'(x) = \frac{\frac{2 \ln x}{x} \cdot (\ln^2 x - a^2) - \frac{2 \ln x}{x} \cdot (\ln^2 x + a^2)}{(\ln^2 x - a^2)^2}$$

$$f'(x) = \frac{2 \ln x [\ln^2 x - a^2 - (\ln^2 x + a^2)]}{x(\ln^2 x - a^2)^2}$$

$$f'(x) = \frac{-4a^2 \ln x}{x}$$

$\ln x = 0 \rightarrow x = 1 \rightarrow y = \frac{\ln^2 1 + a^2}{\ln^2 1 - a^2} = \frac{a^2}{-a} = -1 \rightarrow \boxed{A(1, -1)}$

.(,) A(1, -1) :

$$(a > 0), g(x) = \frac{\ln^2 x - a^2}{\ln^2 x + a^2}$$

() $x > 0$

, $f(x)$

$$g(x) = \frac{1}{f(x)}$$

$(e^{-a}, 0), (e^a, 0) : x -$

, $f(x)$

$$\frac{\ln^2 x}{\ln^2 x}$$

$y = 1$

$(0, 1)$

$$\frac{1}{f(x)}$$

, $f(x)$

$$g'(x) = \left(\frac{1}{f(x)}\right)' = -\frac{f'(x)}{f^2(x)}$$

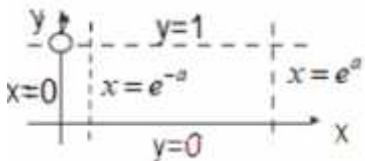
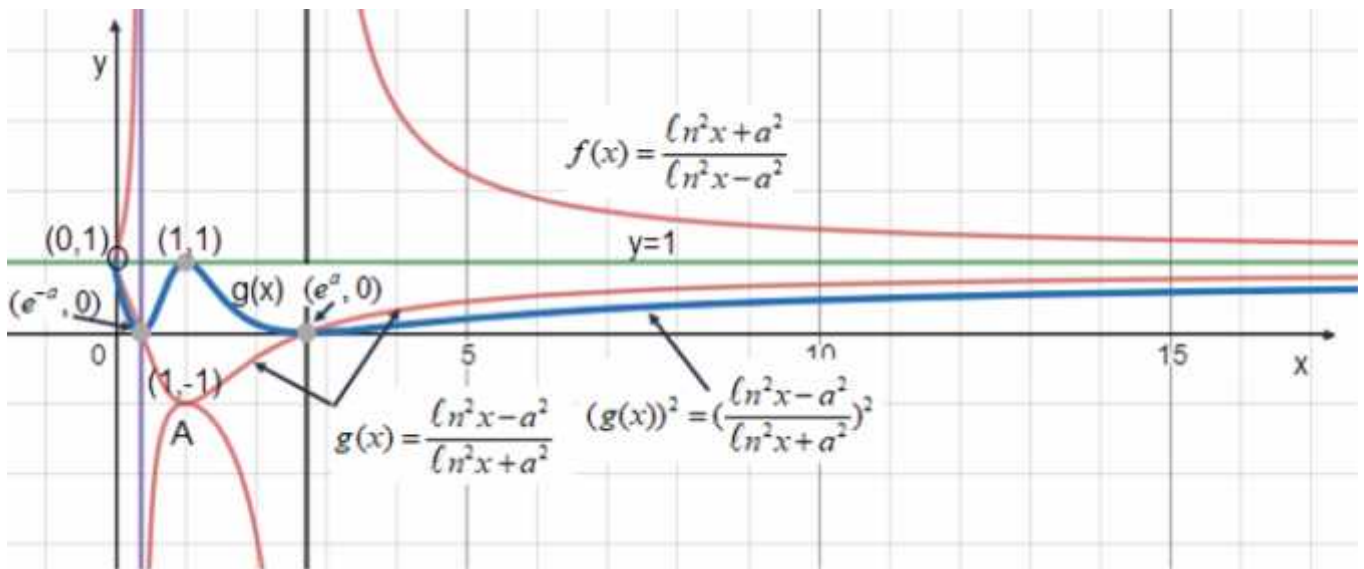
, $g(x)$

$$(a > 0), (g(x))^2 = \left(\frac{\ln^2 x - a^2}{\ln^2 x + a^2}\right)^2$$

, $g(x) < 0$

$$(g^2(x))' = 2 \frac{g(x)}{(-)} g'(x) : (g(x) < 0)$$

$$0 < g^2(x) < g(x) < 1 \quad 0 < g(x) < 1 :$$



$$, a = 1 - , e^a \cdot 1 = e , x = e^a$$

$$, a = -1 - , e^{-a} \cdot 1 = e , x = e^{-a}$$

. $a = 1 :$

$$f(x) = e^x \cdot \sqrt[3]{x^2}$$

$$x \tag{1}$$

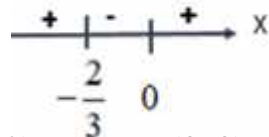
$$\tag{2}$$

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

$$f'(x) = e^x \cdot x^{-\frac{1}{3}} \left(x + \frac{2}{3}\right) \rightarrow f'(x) = \frac{e^x \left(x + \frac{2}{3}\right)}{\sqrt[3]{x}}$$

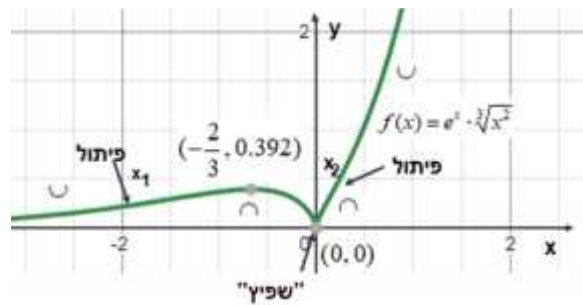
$x = 0$
 $x = 0$
 $f'(x)$

$$x = -\frac{2}{3}$$



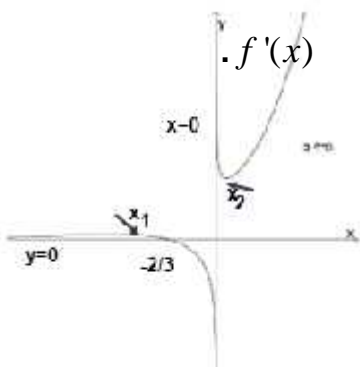
$(-\frac{2}{3}, 0.392)$, $(0, 0)$, $-\frac{2}{3} < x < 0$, $x < -\frac{2}{3}$, $x > 0$

$$y = 0 - +\infty - \sqrt[3]{x^2} \quad 0 - e^x - x \rightarrow -\infty \tag{3}$$



$$f'(x) \quad x = 0 \tag{4}$$

$f(x)$



$$f(x)$$

$$0 - f'(x)$$

$$y = 0 \quad f'(x)$$

' :

$$g(x) = e^x \cdot \sqrt[3]{x} \quad (1)$$

$$x \quad (2)$$

$x < 0$, $x > 0$

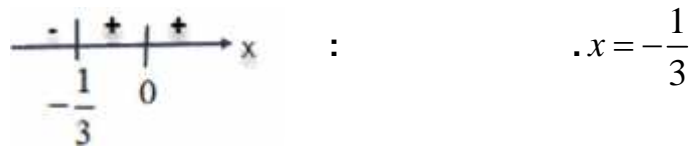
$$g(x) = e^x \cdot x^{\frac{1}{3}} \rightarrow g'(x) = e^x \cdot x^{\frac{1}{3}} + \frac{1}{3} e^x \cdot x^{-\frac{2}{3}}$$

$$g'(x) = e^x \cdot x^{-\frac{2}{3}} \left(x + \frac{1}{3} \right) \rightarrow g'(x) = \frac{e^x \left(x + \frac{1}{3} \right)}{\sqrt[3]{x^2}}$$

: , () $x = 0$ ()

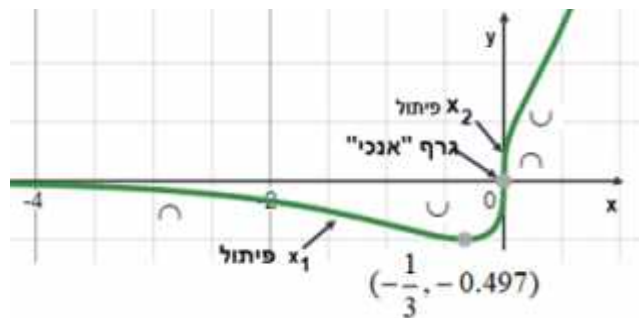
$f(x)$, !!! ($y = \dots$) $x = 0$

$x \neq 0$, () , $f'(x)$. () " "



$(-\frac{1}{3}, -0.497)$. $x < -\frac{1}{3}$ $x > -\frac{1}{3}$:

$y = 0$ - $+\infty$ - $\sqrt[3]{x}$ 0 - e^x - $x \rightarrow -\infty$ (3)



$f'(x)$, $x = 0$ (4)

: ()

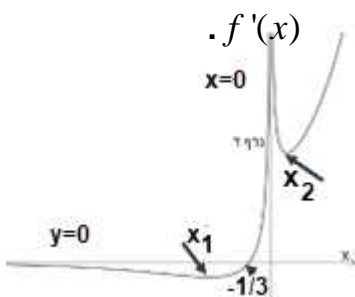
() , $f'(x)$

$f(x)$, ()

, 0 -

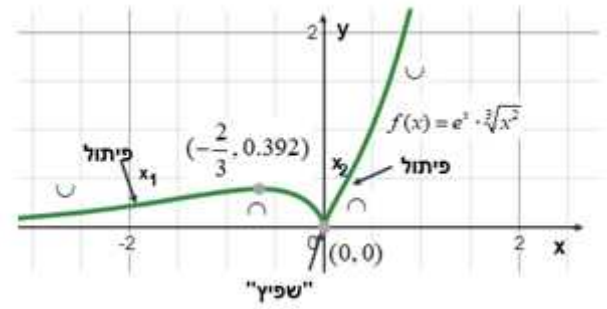
$y = 0$ $f'(x)$

: :



$$h(x) = \frac{1}{e^{f(x)}}$$

$$f(x)$$



$$x \rightarrow \pm\infty, \quad y$$

$$e^{f(x)} \rightarrow +\infty, \quad f(x) \rightarrow +\infty, \quad x \rightarrow +\infty$$

$$y = 0 - h(x) = \frac{1}{e^{f(x)}} \rightarrow \frac{1}{+\infty} \rightarrow 0, \quad x \rightarrow +\infty$$

$$e^{f(x)} \rightarrow e^0 \rightarrow 1, \quad f(x) \rightarrow +0, \quad x \rightarrow -\infty$$

$$y = 1 - h(x) = \frac{1}{e^{f(x)}} \rightarrow \frac{1}{1} \rightarrow 1, \quad x \rightarrow -\infty$$

$$y = 1, \quad y = 0 :$$

$5K$	K	$M_0 - (\quad)$
$(g(x) = g(0)b^x) \rightarrow b$	a	$q -$
3	3	$t - (\quad)$
$\frac{5}{8}L = 5Kb^3$	$L = Ka^3$	$M_t -$

$$5Kb^3 = \frac{5}{8}Ka^3 \quad /: \frac{K}{8} > 0$$

$$8b^3 = a^3$$

$$\boxed{a = 2b}$$

, (t)

$$5Kb^t = Ka^t \quad /: K > 0$$

$$5b^t = (2b)^t \quad \leftarrow a = 2b$$

$$5b^t = 2^t b^t \quad /: b^t > 0$$

$$5 = 2^t$$

$$\boxed{t = \log_2 5 \approx 2.322}$$

$$\log_2 5 \approx 2.322 \quad :$$

(x)

$$f(x) = K \cdot (2b)^x \quad (1)$$

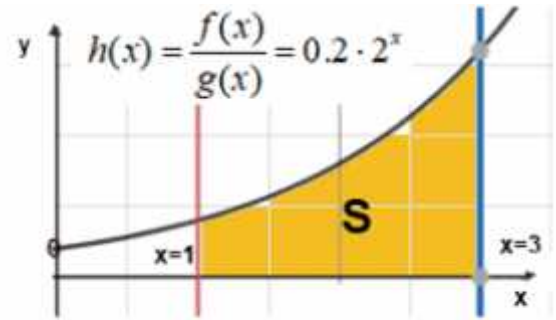
$$g(x) = 5K \cdot b^x \quad (2)$$

$$h(x) = \frac{f(x)}{g(x)}$$

$$h(x) = \frac{K \cdot (2b)^x}{5K \cdot b^x} = \frac{2^x \cdot b^x}{5 \cdot b^x}$$

$$\boxed{h(x) = 0.2 \cdot 2^x}$$

.(,) $x > 0$, x ,



$$S = \int_1^3 (0.2 \cdot 2^x - 0) dx$$

$$S = \left. \frac{0.2 \cdot 2^x}{\ln 2} \right|_1^3$$

$$\left. \begin{array}{l} x=3: \frac{0.2 \cdot 2^3}{\ln 2} = \frac{1.6}{\ln 2} \\ x=1: \frac{0.2 \cdot 2^1}{\ln 2} = \frac{0.4}{\ln 2} \end{array} \right\} S = \frac{1.6}{\ln 2} - \frac{0.4}{\ln 2} = \boxed{\frac{1.2}{\ln 2} \approx 1.731}$$

$$\cdot \text{ " } \frac{1.2}{\ln 2} \approx 1.731 \quad :$$