

הפיתרון מוצע ע"י ניר דהן

2

$$a_1, a_2, a_3, \dots, a_n, \dots$$

הקשר
הרצוי

806 7/16 ב"ח

$$a_n - a_3 = 4(a_2 - a_1)$$

נכון

$$\Rightarrow a_1 q^3 - a_1 q^2 = 4(a_1 q - a_1)$$

$$a_1 q^2 (q-1) = 4a_1 (q-1) \quad / : a_1 (q-1) \quad (a_1 \neq 0 \quad q \neq 1)$$

$$q^2 = 4 \Rightarrow q = \pm 2$$

הקשר
הרצוי

$$q > 1 \Rightarrow \boxed{q = 2} \quad \text{נכון}$$

$$a_6 = a_1 + 31$$

$$a_1 q^5 = a_1 + 31$$

$$32a_1 = a_1 + 31 \Rightarrow \boxed{a_1 = 1} \quad \text{נכון}$$

2)

I הקשר

$$a_1 \cdot a_2, a_2 \cdot a_3, a_3 \cdot a_4, \dots, a_n \cdot a_{n+1}, \overbrace{a_{n+1} \cdot a_{n+2}}^{b_n}$$

$$\frac{b_{n+1}}{b_n} = \frac{a_{n+2} \cdot a_{n+3}}{a_{n+1} \cdot a_{n+2}} = \frac{\cancel{a_n} \cdot \cancel{q^2} \cdot \cancel{a_n} \cdot q^3}{\cancel{a_n} \cdot q \cdot \cancel{a_n} \cdot q^2} = \underline{q^2 = 4} \quad \text{הקשר הרצוי}$$

II הקשר

$$\frac{a_2}{a_1} + \frac{a_3}{a_2} : \frac{a_3}{a_2} + \frac{a_4}{a_3} : \dots : \overbrace{\frac{a_{n+1}}{a_n} + \frac{a_{n+2}}{a_{n+1}}}^{C_n}$$

$$C_n = \frac{a_{n+1}}{a_n} + \frac{a_{n+2}}{a_{n+1}} = \frac{(a_{n+1})^2 + a_n \cdot a_{n+2}}{a_n \cdot a_{n+1}}$$

$$\frac{C_{n+1}}{C_n} = \frac{\frac{(a_{n+2})^2 + a_{n+1} \cdot a_{n+3}}{a_{n+1} \cdot a_{n+2}}}{\frac{(a_{n+1})^2 + a_n \cdot a_{n+2}}{a_n \cdot a_{n+1}}} = \frac{\frac{(a_n \cdot q^2)^2 + a_n q \cdot a_n q^3}{a_n q \cdot a_n q^2}}{\frac{(a_n q)^2 + a_n \cdot a_n q^2}{a_n \cdot a_n q}}$$

$$\frac{\frac{a_n^2 q^4 + a_n^2 q^4}{a_n^2 \cdot q^3}}{\frac{a_n^2 \cdot q^2 + a_n^2 q^2}{a_n^2 q}} = \frac{\frac{2\cancel{a_n^2} q^4}{\cancel{a_n^2} \cancel{q^3}}}{\frac{2\cancel{a_n^2} q^2}{\cancel{a_n^2} \cancel{q}}} = \frac{2q}{2q}$$

$$= 1 \quad \leftarrow \quad \boxed{\begin{array}{l} \text{סדרה קבועה} \\ \text{מן מילוי} \end{array}}$$

$$\text{לד.נ. } 1 \quad \boxed{\begin{array}{l} \text{סדרה I - הנדסה - סדרה 1/2} \\ \text{סדרה II - סדרה קבועה} \end{array}}$$

$$\sum_{n=1}^{\infty} = 2730$$

$$b_1 = a_1 \cdot a_2 = 1 \cdot 2 = 2$$

$$q_b = 4$$

$$\Rightarrow \frac{2(4^{n+1} - 1)}{4 - 1} = 2730 \Rightarrow 4^{n+1} = 4096$$

$$\boxed{n+1 = \frac{\ln 4096}{\ln 4} = 6} \quad \begin{array}{l} \text{לד.נ.} \\ \text{זכור} \end{array}$$

$$\underline{\underline{\text{II סדרה}}}$$

$$\text{כיון} \quad \frac{a_2}{a_1} + \frac{a_3}{a_2} = \frac{2}{1} + \frac{4}{2} = 4$$

$$q = 1$$

$$n = 5$$

$$\Rightarrow 4 \cdot 5 = \underline{\underline{20}} \\ \text{זכור}$$

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$$P(\text{זוג בלבד} \mid \text{זוג}) = \frac{1}{32} \quad (\text{חיון})$$

$$\Rightarrow P^5 = \frac{1}{32} \Rightarrow \boxed{P = \frac{1}{2}}$$

$$P(\text{זוג בלבד} \mid \text{זוג}) = \frac{1}{2}$$

$$P(\text{זוג בלבד} \mid \text{זוג}) = P \quad (P \neq 0 \quad \text{חיון})$$

$$P(\text{זוג בלבד} \mid \text{זוג}) = \frac{1}{2} - P$$

$$P(\text{זוג בלבד} \mid \text{זוג}) = P(\text{זוג בלבד} \mid \text{זוג}) : (\text{חיון})$$

$$\Rightarrow \binom{5}{2} \cdot P^2 \cdot (1-P)^3 = \binom{5}{1} \cdot P \cdot (1-P)^4$$

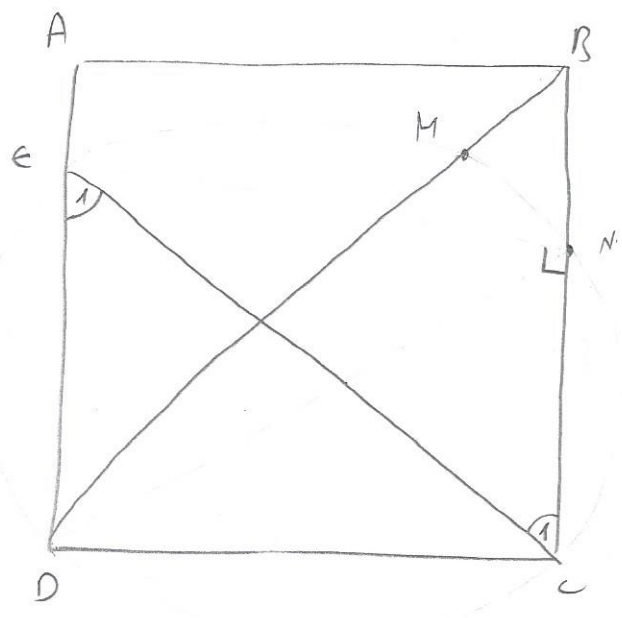
$$10 \cdot P^2 (1-P)^3 = 5 \cdot P \cdot (1-P)^4 \quad / : 5 P (1-P)^3 \quad P \neq 0 \quad 0 < 1-P < \frac{1}{2}$$

$$2P = 1-P \Rightarrow \boxed{P = \frac{1}{3}} \quad \underline{\underline{\text{חיון}}}$$

$$\Rightarrow \boxed{P(\text{זוג בלבד} \mid \text{זוג}) = \frac{1}{2} - \frac{1}{3} = \frac{1}{6}} \quad \underline{\underline{\text{חיון}}}$$

$$\begin{aligned} \text{ד) } P(\text{זוג בלבד} \mid \text{זוג}) &= \frac{P(\text{זוג בלבד} \mid \text{זוג}) \cap P(\text{זוג בלבד} \mid \text{זוג})}{P(\text{זוג בלבד} \mid \text{זוג})} \\ &= \frac{\frac{1}{6} \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{6}}{\frac{1}{6} \cdot \frac{1}{2} + \frac{1}{2} \cdot \frac{1}{6} + \frac{1}{3} \cdot \frac{1}{3}} \leftarrow \left(\begin{array}{c} \text{זוג בלבד} \\ \text{זוג בלבד} \\ \text{זוג בלבד} \end{array} \right) \\ &= \frac{\frac{1}{6}}{\frac{1}{6} + \frac{1}{9}} = \underline{\underline{\frac{3}{5}}} \quad \underline{\underline{\text{חיון}}} \end{aligned}$$

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- 1) $ABCD$ ריבוי נחיון
- 2) $\angle D = 90^\circ$ (רבי. 1 + צל. ריבוי שול.)
- 3) $E \in AD$ (רבי. 2 + צל. הקר. טרה וסל. א) קר.
- 4) $\angle E = \angle C$ (רבי. 1 + צל. למעלה בן טרה וקבלי.)
- 5) $\boxed{EN = DC}$ (רבי. 4 + צל. הקבלי שול. וסל. א) מיתרים שווים
לכל $E \in AD$
- 6) $\angle C = 90^\circ$ (רבי. 1 + צל. ריבוי שול.)
- 7) $M \in EN$ (רבי. 6 + מסל. שול. 3)
- 8) $DM \perp EN$ (רבי. 7)
- 9) $\boxed{DM < EN}$ (רבי. 3, 8 + קר. הא הליחי הקר.) כלי.
לכל $E \in AD$
- 10) $\angle ENC = 90^\circ$ (רבי. 3 + צל. הקר. הקל. א) קר.)
- 11) $\angle ENC = 90^\circ$ (רבי. 2, 6, 10 + טרה צל. בארבע 360°)
- 12) $E \in NC$ (רבי. 2, 6, 10, 11 + לרוב של צל. יסל. א) הא חבן
לכל $E \in AD$

←

$$13) \quad ED = NC \quad ($$

(חכ' 2 + צלע נגד - בלבן שול.)

$$14) \quad \boxed{AD = BC} \quad ($$

(חכ' 1 + צלע נגד - בריבוע שול.)

$$15) \quad \boxed{BN = AE} \quad ($$

(חכ' 3, 4 + ח'ט"ו (צלע - שווים.

$$16) \quad BM \cdot BD = BN \cdot BC \quad ($$

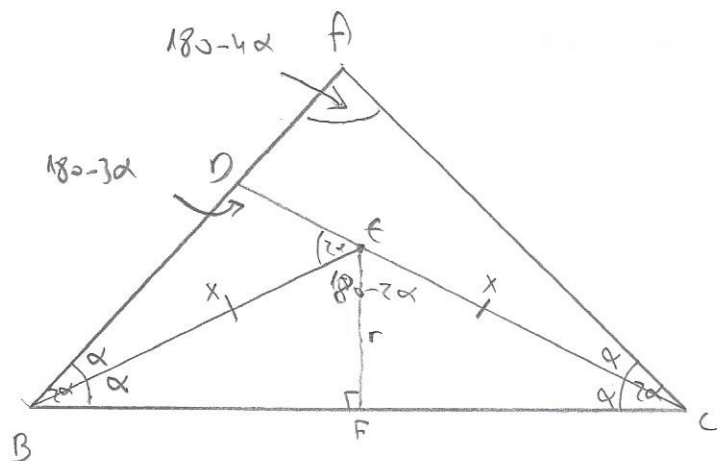
(אם נקודה שחוצצת ישרים בני זווית
אז אנחנו קיבלנו השוויון
שניהם אנחנו קיבלנו השוויון

$$\boxed{BM \cdot BD = AE \cdot AD}$$

$\therefore R.N$

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1) $AB = AC$ (given)

2) $\angle B = \angle C = 2\alpha$ (given + 1st condition)

3) $\angle A = 180 - 4\alpha$ (180° in $\triangle ABC$ is $180 + 2$ angles)

4) $\angle DBE = \angle ECB = \angle ACD = \angle ECD = \alpha$ (3rd condition $\mu \in$ given + 2 angles in $\triangle ABC$)

5) $BE = EC = x$ (1st condition $\triangle BEC$ is $180 + 4$ angles + 1st condition)

6) $\frac{EC}{DE} = \frac{\sqrt{3}}{2\sin\alpha}$ (given)

7) $\angle BEC = 180 - 2\alpha$ (180° in $\triangle BEC$ is $180 + 4$ angles)

8) $\angle BED = 2\alpha$ (180° in $\triangle BED$ is $180 + 7$ angles)

9) $\angle BDE = 180 - 3\alpha$ (180° in $\triangle BDE$ is $180 + 8, 4$ angles)

10) $\triangle DEB$

$$\frac{DE}{\sin\alpha} = \frac{x}{\sin(180-3\alpha)} \Rightarrow DE = \frac{x \cdot \sin\alpha}{\sin 3\alpha}$$

←

$$11) \frac{EC}{DE} = \frac{\cancel{X}}{\frac{\cancel{X} \cdot \sin \alpha}{\sin 3\alpha}} = \frac{\sin 3\alpha}{\sin \alpha}$$

$$\Rightarrow \frac{\sin 3\alpha}{\sin \alpha} = \frac{\sqrt{3}}{2 \sin \alpha} \quad (\text{ " , 6 " })$$

$$2 \sin \alpha \cdot \sin 3\alpha - \sqrt{3} \sin \alpha = 0$$

$$\sin \alpha (2 \sin 3\alpha - \sqrt{3}) = 0$$

$$\sin \alpha = 0$$

$$\alpha = 180^\circ \quad \text{אם } \alpha \text{ הוא } 180^\circ \text{ אז } \sin \alpha = 0$$

$$\sin 3\alpha = \frac{\sqrt{3}}{2}$$

$$3\alpha = 60^\circ + 360^\circ k / 3 \quad 3\alpha = -60^\circ + 360^\circ k$$

$$\alpha = 20^\circ + 120^\circ k$$

אם $\alpha = 180^\circ$ אז $\sin \alpha = 0$ וזה לא מתאים.

$$\boxed{\alpha = 20^\circ}$$

הזווית α היא הזווית בין היתר BC לבין היסוס.

$$12) EF \perp BC \quad (\text{ " , 6 " })$$

$$\triangle EFB$$

$$\frac{EF}{X} = \sin 20^\circ \Rightarrow \boxed{EF = X \cdot \sin 20^\circ = 0.342 X}$$

$$\triangle BEC$$

$$\frac{BC}{\sin(180-2\alpha)} = \frac{X}{\sin \alpha} \Rightarrow BC = \frac{X \cdot \sin 2\alpha}{\sin \alpha} = 2X \cos 20^\circ = 1.879 X$$

$\triangle ABC$

6

$$f(x) = a \cdot \sin^2 x + b \cdot \cos 4x \quad 0 \leq x \leq \frac{2\pi}{3}$$

$$f\left(\frac{\pi}{3}\right) = 0 \quad | \text{in}$$

$$f'(x) = 2a \sin x \cdot \cos x - 4b \sin 4x$$

$$\boxed{f'(x) = a \sin 2x - 4b \sin 4x}$$

$$f'\left(\frac{\pi}{3}\right) = 0 \Rightarrow a \cdot \sin \frac{2\pi}{3} - 4b \sin \frac{4\pi}{3} = 0$$

$$\frac{a\sqrt{3}}{2} + \frac{4b\sqrt{3}}{2} = 0 \quad | : \frac{\sqrt{3}}{2}$$

$$a + 4b = 0$$

$$\boxed{a = -4b}$$

$$f(x) = -4b \sin^2 x + b \cos 4x$$

$$f'(x) = -4b \sin 2x - 4b \sin 4x$$

$$\boxed{f'(x) = -4b (\sin 2x + \sin 4x)}$$

b)

11'7'2

$$f'(x) = 0 \Rightarrow \sin 2x + \sin 4x = 0 \quad (b \neq 0)$$

$$\sin 2x + 2 \sin 2x \cos 2x = 0$$

$$\sin 2x (1 + 2 \cos 2x) = 0$$

$$\textcircled{1} \sin 2x = 0$$

$$\textcircled{2} \cos 2x = -\frac{1}{2}$$

$$2x = \pi | k \quad | : 2$$

$$\boxed{x = \frac{\pi}{2} k}$$

$$k=0 \quad x=0 \quad \checkmark$$

$$k=1 \quad x=\frac{\pi}{2} \quad \checkmark$$

$$2x = \frac{2\pi}{3} + 2\pi | k \quad | : 2$$

$$\boxed{x = \frac{\pi}{3} + \pi | k}$$

$$x = \frac{\pi}{3} \quad \checkmark$$

$\emptyset$

$$2x = -\frac{2\pi}{3} + 2\pi | k \quad | : 2$$

$$\boxed{x = -\frac{\pi}{3} + \pi | k}$$

$$x = -\frac{\pi}{3} \quad \emptyset$$

$$x = \frac{2\pi}{3} \quad \checkmark$$

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$$f(0) = -4b \sin^2(0) + b \cos 0 = b \Rightarrow (0, b)$$

$$f\left(\frac{\pi}{3}\right) = -4b \sin^2\left(\frac{\pi}{3}\right) + b \cos\left(\frac{2\pi}{3}\right) = -3.5b \Rightarrow \left(\frac{\pi}{3}, -3.5b\right)$$

$$f\left(\frac{\pi}{2}\right) = -4b \sin^2\left(\frac{\pi}{2}\right) + b \cos(\pi) = -3b \Rightarrow \left(\frac{\pi}{2}, -3b\right)$$

$$f\left(\frac{2\pi}{3}\right) = -4b \sin^2\left(\frac{2\pi}{3}\right) + b \cos\left(\frac{4\pi}{3}\right) = -3.5b \Rightarrow \left(\frac{2\pi}{3}, -3.5b\right)$$

$$f'(x) = -4b(2\cos 2x + 4\cos 4x)$$

$$f'(x) = -8b(\cos 2x + 2\cos 4x)$$

$$f''(0) = -8b(\cos 0 + 2\cos 0) = -24b > 0 \Rightarrow \min(0, b)$$

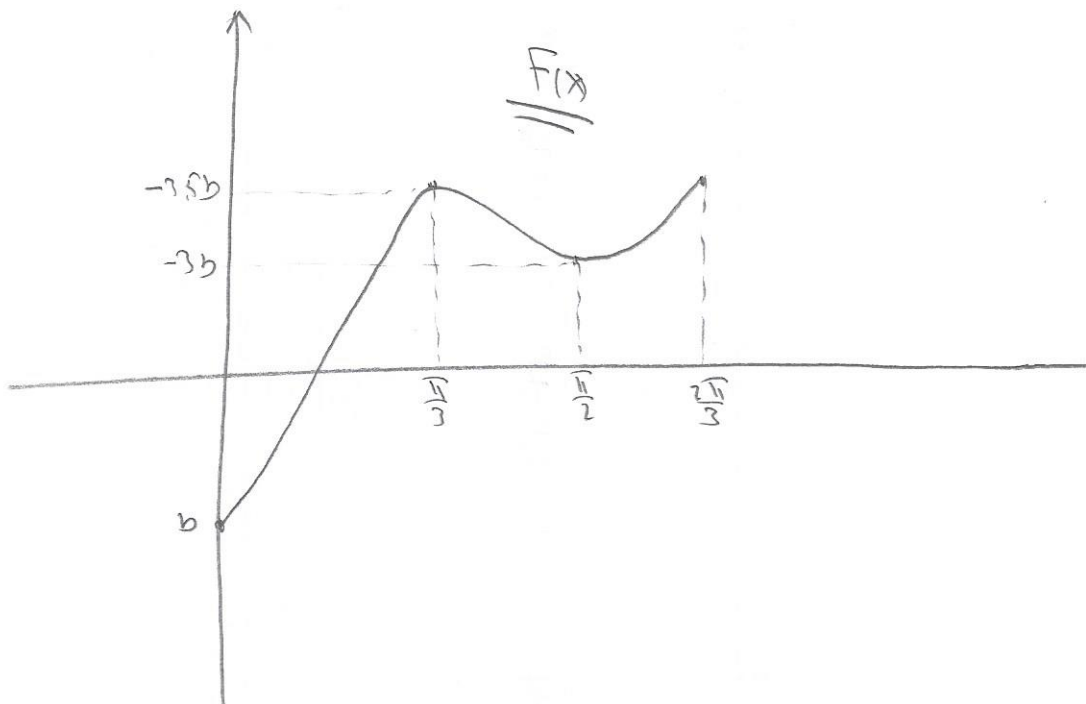
$$f''\left(\frac{\pi}{3}\right) = -8b(\cos \frac{2\pi}{3} + 2\cos \frac{4\pi}{3}) = 12b < 0 \Rightarrow \max\left(\frac{\pi}{3}, -3.5b\right)$$

$$f''\left(\frac{\pi}{2}\right) = -8b(\cos \pi + 2\cos 2\pi) = -8b > 0 \Rightarrow \min\left(\frac{\pi}{2}, -3b\right)$$

$$f''\left(\frac{2\pi}{3}\right) = -8b(\cos \frac{4\pi}{3} + 2\cos \frac{8\pi}{3}) = 12b < 0 \Rightarrow \max\left(\frac{2\pi}{3}, -3.5b\right)$$

1. R. d.

2)

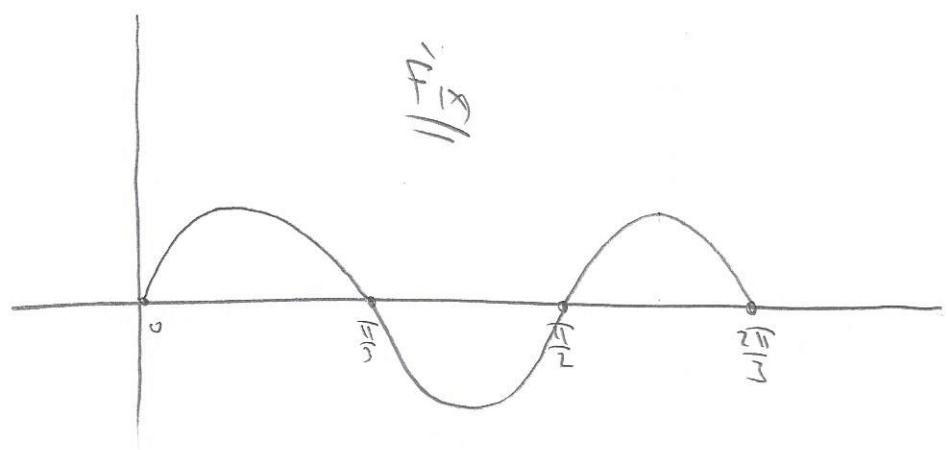


4)

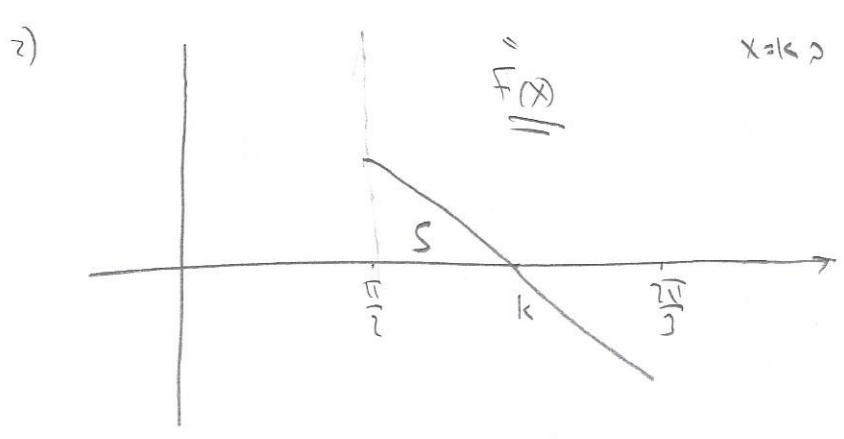
מציאת סימני $f''(x)$ →

סימני $f''(x)$ →

x	0	$0 < x < \frac{\pi}{3}$	$\frac{\pi}{3}$	$\frac{\pi}{3} < x < \frac{\pi}{2}$	$\frac{\pi}{2}$	$\frac{\pi}{2} < x < \frac{2\pi}{3}$	$\frac{2\pi}{3}$
$f''(x)$		+		-		+	
סימני $f''(x)$		↗		↘		↗	



3) 1) $\int_{\frac{\pi}{2}}^{\frac{2\pi}{3}} f''(x) dx = \left[f'(x) \right]_{\frac{\pi}{2}}^{\frac{2\pi}{3}} = f'\left(\frac{2\pi}{3}\right) - f'\left(\frac{\pi}{2}\right) = 0$



$x=k \Rightarrow f''(x) > 0 \Leftrightarrow f''(x) = 0$

$\frac{\pi}{2} < x < k$

$f''(x) > 0 \Leftrightarrow f''(x)$

$k < x < \frac{2\pi}{3}$

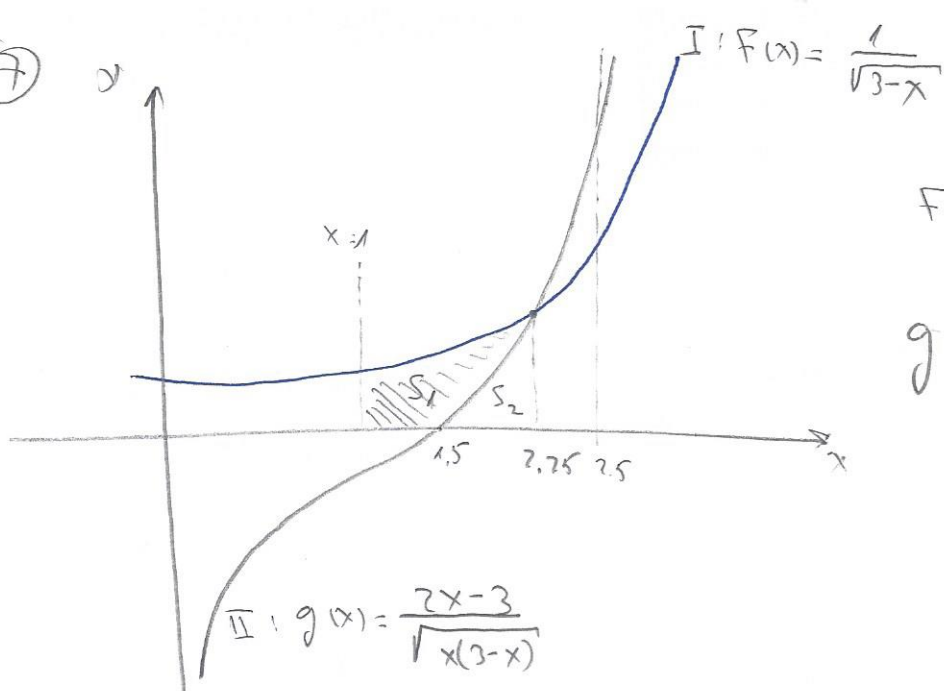
$f''(x) < 0 \Leftrightarrow f''(x)$

$\int_{\frac{\pi}{2}}^k f''(x) dx = S$ (1)

$\int_{\frac{\pi}{2}}^{\frac{2\pi}{3}} f''(x) dx = 0$ (2)

$\Rightarrow \boxed{\int_k^{\frac{2\pi}{3}} f''(x) dx = S}$

(7)



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$$F(x) = \frac{1}{\sqrt{3-x}}$$

$$g(x) = \frac{2x-3}{\sqrt{x(3-x)}}$$

$$F(0) = \frac{\sqrt{3}}{3}$$

$$I: F(x)$$

$$g(0) = \frac{-3}{0}$$

 $\Rightarrow$

$$II: g(x)$$

b) 1) $F(x)$ גדרה

$$3-x > 0 \Rightarrow \boxed{x < 3}$$

$g(x)$ גדרה

$$x(3-x) > 0 \Rightarrow$$



$$\boxed{0 < x < 3}$$

2) $F(x)$ גבולות

$$3-x = 0 \Rightarrow \boxed{x = 3}$$

גבול

גבול

$$\lim_{x \rightarrow -\infty} \frac{1}{\sqrt{3-x}} = \frac{1}{\sqrt{3+\infty}} = \frac{1}{\sqrt{\infty}} = 0 \Rightarrow$$

$$\boxed{x \rightarrow -\infty, y = 0}$$

←

$$g(x) = \sqrt{3-x}$$

$$f'(x) = \frac{1}{2\sqrt{3-x}}$$

$$x(3-x) = 0$$

$$\Rightarrow \begin{cases} x=0 \\ x=3 \end{cases}$$

$$2) F(x) = g(x)$$

$$(*) \frac{1}{\sqrt{3-x}} = \frac{2x-3}{\sqrt{x(3-x)}} \quad \uparrow^2$$

$$\frac{1}{3-x} = \frac{(2x-3)^2}{x(3-x)} \Rightarrow x(3-x) = (3-x)(4x^2 - 12x + 9) \quad / : 3-x \neq 0$$

$x \neq 3$
מכאן, $x \neq 3$

$$x = 4x^2 - 12x + 9$$

$$4x^2 - 13x + 9 = 0$$

$$x_{1,2} = \frac{13 \pm 5}{8} \rightarrow \begin{cases} x_1 = 2.25 \\ x_2 = 1 \end{cases}$$

כל נקודה
(*) שייכת

x נ"ל -0 g(x) ב' נקודה זו -1.5

$$\frac{2x-3}{\sqrt{x(3-x)}} = 0 \Rightarrow 2x-3=0 \Rightarrow x=1.5$$

$$S_1 + S_2 = \int_1^{2.25} \frac{1}{\sqrt{3-x}} dx = \int_1^{2.25} (3-x)^{-\frac{1}{2}} dx = \left[\frac{(3-x)^{\frac{1}{2}}}{-\frac{1}{2}} \right]_1^{2.25} = \left[-2\sqrt{3-x} \right]_1^{2.25}$$

$$= -2\sqrt{0.75} - [-2\sqrt{2}] = -\sqrt{3} + 2\sqrt{2} = 1.096$$



$$S_2 = \int_{1.5}^{2.25} \frac{2x-3}{\sqrt{3x-x^2}} dx \quad \text{sub } \boxed{u = 3x - x^2 \Rightarrow du = (3-2x) dx}$$

$$\Rightarrow dx = \frac{du}{-(2x-3)}$$

$$= \int_{1.5}^{2.25} \frac{\cancel{2x-3}}{\sqrt{u}} \cdot \frac{du}{-(\cancel{2x-3})} = \int_{1.5}^{2.25} -u^{-\frac{1}{2}} du = \left[-\frac{u^{\frac{1}{2}}}{\frac{1}{2}} \right]_{1.5}^{2.25}$$

$$= \left[-2\sqrt{u} \right]_{1.5}^{2.25} = \left[-2\sqrt{x(3-x)} \right]_{1.5}^{2.25} =$$

$$= -2\sqrt{1.6875} - (-2\sqrt{2.25}) = \underline{\underline{0.4}}$$

$$\Rightarrow \boxed{S_2 = 1.096 - 0.4 = 0.696}$$

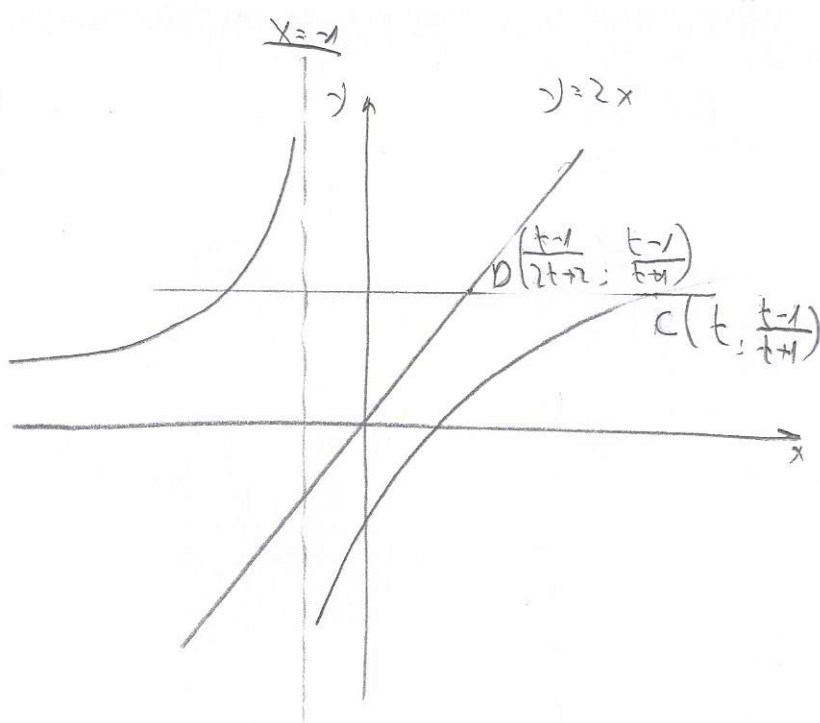
$$c) S_1 = \int_{2.25}^{2.5} [f(x) - g(x)] dx$$

$$S_2 = \int_{2.25}^{2.5} \left[\frac{1}{\sqrt{3-x}} + 2 - \left(\frac{2x-3}{\sqrt{x(3-x)}} + 2 \right) \right] dx = \int_{2.25}^{2.5} \left[\frac{1}{\sqrt{3-x}} - \frac{2x-3}{\sqrt{x(3-x)}} \right] dx$$

$$= \int_{2.25}^{2.5} [f(x) - g(x)] dx$$

$$\Rightarrow \boxed{S_1 = S_2} \quad \underline{\underline{\text{K.O.}}}$$

8)



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$$f(x) = \frac{x-1}{x+1}$$

1)

הפונקציה

$$x+1 \neq 0 \Rightarrow \boxed{x \neq -1}$$

אין נקודה

$$x+1 = 0 \Rightarrow \boxed{x = -1}$$

אין נקודה

$$\lim_{x \rightarrow \pm\infty} \frac{x-1}{x+1} : x = \lim_{x \rightarrow \pm\infty} \frac{1 - \frac{1}{x}}{1 + \frac{1}{x}} = \frac{1 - \frac{1}{\infty}}{1 + \frac{1}{\infty}} = \frac{1}{1} = 1$$

$$\boxed{\begin{matrix} x \rightarrow \pm\infty \\ y = 1 \end{matrix}}$$

$$2) \quad C\left(t, \frac{t-1}{t+1}\right)$$

נקודה

$$D(x, 2x)$$

$$CD \parallel x$$

אז

$$\Rightarrow y_D = y_C \Rightarrow 2x = \frac{t-1}{t+1} \Rightarrow x = \frac{t-1}{2t+2} \Rightarrow \boxed{D\left(\frac{t-1}{2t+2}, \frac{t-1}{t+1}\right)}$$

(1) $t > -1$

$$C(t) = t - \frac{t-1}{2t+2} = \frac{2t^2+t+1}{2t+2}$$

$$C'(t) = 1 - \frac{2t+2-2(t+1)}{(2t+2)^2} = 1 - \frac{4}{(2t+2)^2}$$

$$C'(t) = 0 \Rightarrow 1 - \frac{4}{(2t+2)^2} = 0$$

$$\Rightarrow (2t+2)^2 = 4 \begin{cases} \rightarrow 2t+2 = 2 \Rightarrow \boxed{t=0} \\ \rightarrow 2t+2 = -2 \Rightarrow t=-2 \not\in t > -1 \end{cases}$$

$$C''(t) = \frac{16(2t+2)}{(2t+2)^4}$$

$$C''(0) = \frac{32}{16} = 2 > 0 \Rightarrow \boxed{\min t = 0} \quad \underline{\text{f.e.v.}}$$

(2) $t < -1$

$$C(t) = \frac{t-1}{2t+2} - t$$

$$C'(t) = \frac{4}{(2t+2)^2} - 1$$

$$C'(t) = 0 \Rightarrow t=0 \not\in t < -1$$

$$\boxed{t=-2}$$

$$C''(t) = -\frac{16(2t+2)}{(2t+2)^4}$$

$$C''(-2) = \frac{32}{16} > 0 \Rightarrow \boxed{\min t = -2}$$

3) $C(t=0) = \frac{1}{2}$

$C(t=-2) = \frac{3}{2}$

$\Rightarrow$

$$\boxed{\begin{matrix} \text{מקור, חלון} \\ \frac{1}{2} \end{matrix}}$$