

. (") v_1 - ;
 . (") v_2 - ' ,
 (, ,)
 96 ק"מ



(1) 15	(2) v_1	(3) $\frac{15}{v_1}$		
-	-	(4) 0.5		
(5) 81	(6) 90	(7) 0.9		
(8) 15	(9) v_2	(10) $\frac{15}{v_2}$		
(11) 96	(12) v_2	(13) $\frac{96}{v_2}$		

$$\frac{15}{v_1} + \frac{1}{20} = \frac{15}{v_2}$$

$$\frac{15}{v_1} + 0.5 + 0.9 = \frac{96}{v_2}$$

$$\begin{cases} \frac{15}{v_1} + 1.4 = \frac{96}{v_2} \\ \frac{15}{v_1} + \frac{1}{20} = \frac{15}{v_2} \end{cases}$$

$$1.35 = \frac{81}{v_2} \Rightarrow v_2 = 60$$

$$\frac{15}{v_1} + 1.4 = \frac{96}{60} \Rightarrow \frac{15}{v_1} = 0.2 \Rightarrow v_1 = 75$$

. $v_2 = 60$, $v_1 = 75$:

3

12, $\frac{12}{60}$ " 12, " 15

3, " 3, $\frac{3}{60}$ " 3
18

15, $\frac{15}{60}$

12, $\frac{15}{75}$

, $\frac{27}{60} = 0.45$

" $0.45 \cdot 60 = 27$

" 24

, " 3

t

$$90t = 60t + 24$$

$$30t = 24$$

$$t = 0.8 \text{ hours} = 48 \text{ minutes}$$

$$12 + 30 + 48 = 90$$

90

, 18

, 12

:

$$\cdot (c_1 - c_2)^2 + (c_3 - c_4)^2 + \dots + (c_{99} - c_{100})^2 \quad \cdot$$

$$\begin{cases} c_n = a_n - n \\ c_{n+1} = a_{n+1} - (n+1) \end{cases}$$

$$c_n - c_{n+1} = a_n - n - [a_{n+1} - (n+1)]$$

$$c_n - c_{n+1} = a_n - n - a_{n+1} + n + 1$$

$$c_n - c_{n+1} = a_n - a_{n+1} + 1$$

$$c_n - c_{n+1} = -(-1) + 1 \quad \leftarrow d_a = -1$$

$$\boxed{c_n - c_{n+1} = 2}$$

$$\cdot (c_1 - c_2)^2 + (c_3 - c_4)^2 + \dots + (c_{99} - c_{100})^2$$

$$: \quad , \quad 50 , \quad n \quad ,$$

$$(c_1 - c_2)^2 + (c_3 - c_4)^2 + \dots + (c_{99} - c_{100})^2 = 50 \cdot (2)^2 = 200$$

$$\cdot (c_1 - c_2)^2 + (c_3 - c_4)^2 + \dots + (c_{99} - c_{100})^2 = 200 :$$

35581

20

$$\frac{4}{9} = \frac{n \cdot (12 - n)}{12 \cdot 12} + \frac{(12 - n) \cdot n}{12 \cdot 12}$$

$$\frac{4}{9} = \frac{n \cdot (12 - n) + (12 - n) \cdot n}{144} \quad / \cdot 144$$

$$64 = 2n(12 - n)$$

$$2n^2 - 24n + 64 = 0$$

$$n = 8, \quad n = 4 \quad \leftarrow n(\text{blue balls}) > n(\text{red balls})$$

$$n = 8, \quad n = 4$$

8 :

$$\frac{5}{9} = \frac{8^2}{(y+12)^2} + \frac{4^2}{(y+12)^2} + \frac{y^2}{(y+12)^2}$$

$$\frac{5}{9} = \frac{80 + y^2}{(y+12)^2} \quad / \cdot 9(y+12)^2$$

$$5(y+12)^2 = 9(80 + y^2)$$

$$4y^2 - 120y = 0$$

$$y = 30, \quad y = 0 \quad \leftarrow y \text{ is natural}$$

$$y = 30, \quad y = 0$$

30 :

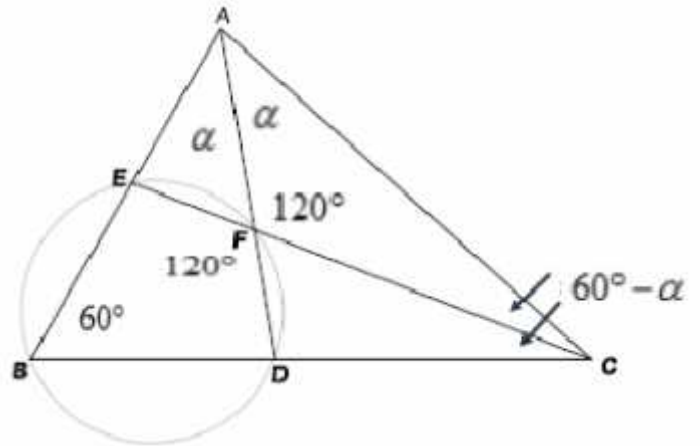
4 - 8

, 3

$$p(3 \text{ blue balls}) = \frac{8}{12} \cdot \frac{7}{11} \cdot \frac{6}{10} = \frac{14}{55}$$

$$\frac{14}{55}$$

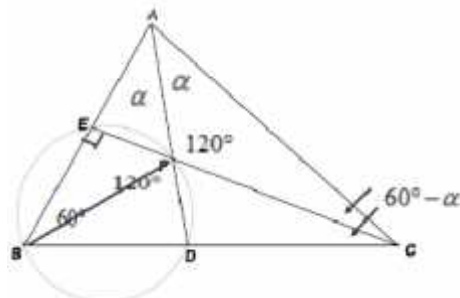
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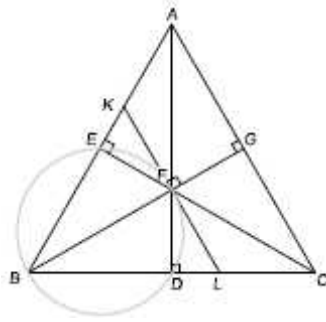
- .1 $\angle CAD = \angle BAD = r$
- .2 $\angle CAD = \angle BAD = r$
- .3 $\angle B = 60^\circ$
- .4 FB
- .5

$\frac{KL}{AC} \cdot FG = R_{BDFE} \cdot \Delta ABC \cdot BDFE \cdot : "$

	$\angle CAD = \angle BAD = r$	6	1
	$\angle B = 60^\circ$	7	3
$180^\circ \Delta ABC -$	$\angle ACE = \angle BCE = 60^\circ - r$	8	7, 6, 2
$180^\circ \Delta AFC -$	$\angle AFC = 120^\circ$	9	8, 7
	$\angle BFD = 120^\circ$	10	9
180°	BDFE	11	10, 7
. . .			



	FB	12	4
,	$\angle FEB = 90^\circ$	13	10, 9
$\Delta AEC -$	$90^\circ = 2r + 60^\circ - r$	14	13, 7, 6
.	$r = 30^\circ$	15	14
60°	ΔABC	16	14, 8, 6
. . .			



"	$\triangle ABC - F$	17	16,8,6
2:1	$BF = 2FG$	18	17,16
	$FG = R_{BDFE}$	19	18,12
. . .			
	KFL	20	5
	$\sphericalangle KFB = 90^\circ$	21	20,12
"	$\sphericalangle AGB = 90^\circ$	22	16,8,6
	$KL \parallel AC$	23	22,21
1	$\frac{BD}{BC} = \frac{BK}{BA}$	24	23
1	$\frac{BK}{BA} = \frac{BF}{BG} = \frac{2}{3}$	25	23
	$\frac{KL}{AC} = \frac{2}{3}$	26	25,24,18
. . .			

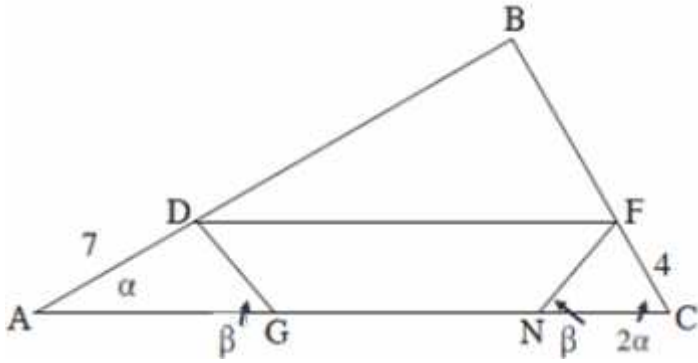
$DG = FN$, $DFNG$ (1) .

$\angle DGA = \angle FNC = s$,

$\triangle ADG$

$$\frac{AD}{\sin s} = \frac{DG}{\sin r}$$

$$\frac{AD}{\sin s} = \frac{FN}{\sin r} \leftarrow DG = FN$$



, r (2)

$\triangle ADG$: (1) $\frac{AD}{\sin s} = \frac{DG}{\sin r}$

$\triangle FCN$: (2) $\frac{FC}{\sin s} = \frac{FN}{\sin 2r}$

(1) $\frac{AD}{\sin s} \cdot \sin s = \frac{DG}{\sin r} \cdot \frac{2 \sin r \cos r}{FN}$

$$\frac{7}{4} = 2 \cos r$$

$$\boxed{r = 28.96^\circ}$$

$r = 28.96^\circ$:

$S_{\triangle BDF} = 56$

$\angle BFD = 2 \cdot 28.96^\circ = 57.91^\circ$, $\angle BDF = 28.96^\circ$

$(180^\circ - 57.91^\circ - 28.96^\circ)$ $\angle B = 93.13^\circ$

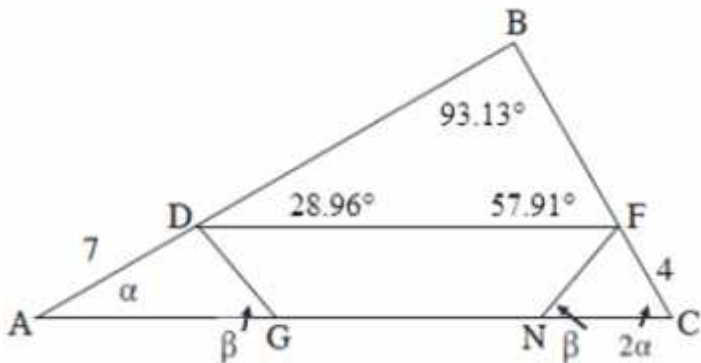
$$S_{\triangle BDF} = \frac{(DF)^2 \sin \angle BDF \cdot \sin \angle BFD}{2 \sin \angle B}$$

$$\frac{56 \cdot 2 \sin 93.13^\circ}{\sin 28.96^\circ \cdot \sin 57.91^\circ} = (DF)^2$$

$$(DF)^2 = 272.62$$

$$\boxed{DF = 16.51}$$

$DF = 16.51$:



$$\frac{R_{\Delta FCN}}{R_{\Delta ADG}}$$

$$\underline{\Delta ADG} : (1) \quad \frac{AD}{\sin S} = 2R_{\Delta ADG}$$

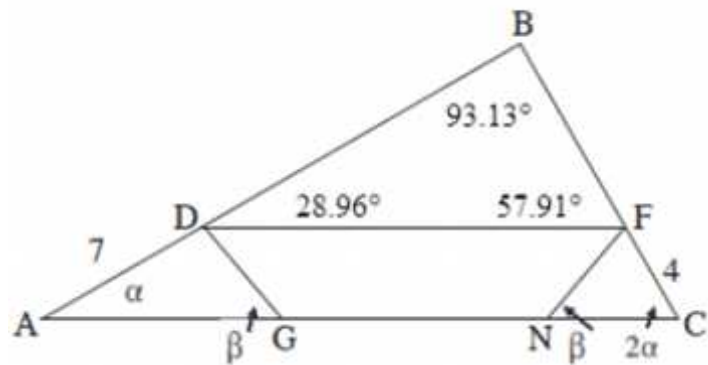
$$\underline{\Delta FCN} : (2) \quad \frac{FC}{\sin S} = 2R_{\Delta FCN}$$

$$(2) \quad \frac{FC}{\sin S} \cdot \frac{\sin S}{AD} = \frac{2R_{\Delta FCN}}{2R_{\Delta ADG}}$$

$$(1) \quad \frac{FC}{AD} = \frac{R_{\Delta FCN}}{R_{\Delta ADG}}$$

$$\boxed{\frac{4}{7} = \frac{R_{\Delta FCN}}{R_{\Delta ADG}}}$$

$$\frac{R_{\Delta FCN}}{R_{\Delta ADG}} = \frac{4}{7} :$$



$0 \leq x \leq 2f$

$f(x) = \frac{6}{2 \cos^2 x - 5 \cos x - 3} :$

(1)

$2 \cos^2 x - 5 \cos x - 3 \neq 0$

$\cos x \neq 3 \text{ o.k.}$

$\cos x \neq -0.5 = \cos \frac{2f}{3}$

$x \neq \frac{2f}{3} + 2fk \rightarrow (k=0) \ x \neq \frac{2f}{3}$

$x \neq -\frac{2f}{3} + 2fk \rightarrow (k=1) \ x \neq \frac{4f}{3}$

$0 \leq x \leq 2f, \ x \neq \frac{2f}{3}, \ x \neq \frac{4f}{3} :$

(2)

$(2f, -1), (0, -1) :$

$f'(x) = \frac{-6 \cdot (-4 \cos x \sin x + 5 \sin x)}{(2 \cos^2 x - 5 \cos x - 3)^2}$

$f'(x) = \frac{6 \cdot (4 \cos x \sin x - 5 \sin x)}{(2 \cos^2 x - 5 \cos x - 3)^2}$

$0 = 4 \cos x \sin x - 5 \sin x$

$0 = \sin x(4 \cos x - 5)$

$\sin x = 0 \quad \cos x = \frac{5}{4} \rightarrow \emptyset$

$x = fk$

$x = 0 \rightarrow (0, -1), (edge \ points)$

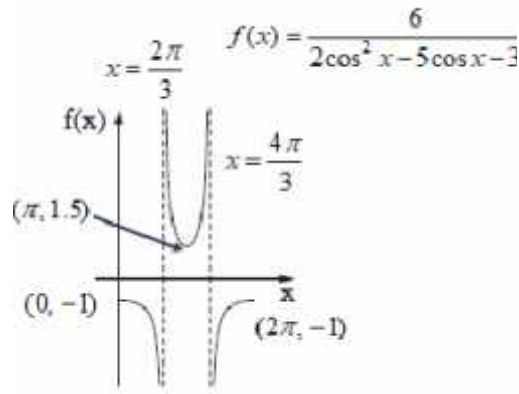
$x = f \rightarrow (f, 1.5)$

$x = 2f \rightarrow (2f, -1), (edge \ points)$

x	0		$\frac{2f}{3}$		f		$\frac{4f}{3}$		$2f$
$f'(x)$		-		-	0	+		+	1
	Max	↘		↘	Min	↗		↗	Max

$(0, -1), (f, 1.5), (2f, -1) :$

$$x = \frac{2f}{3}, x = \frac{4f}{3}, \quad (3)$$



$$0 \leq x \leq 2f, \quad h(x) = |f(x) + 2| : \quad (1)$$

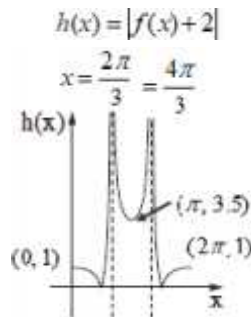
$$f(x)$$

$$f(x)$$

$$(2f, 1), (0, 1)$$

$$(f, 3.5)$$

$x -$



$$h(x) = |f(x) + 2| \quad y = k \quad (2)$$

$x -$

$$(f, 3.5)$$

$$0 < k \leq 1, k > 3.5 :$$

$$0 \leq x \leq 2f$$

$$h(x) = |f(x) + 2| :$$

$$h(x) = f(x), \quad \frac{2f}{3} < x < \frac{4f}{3}$$

$$-2 < f(x) < 0$$

$$x \quad h(x) < f(x) :$$

$$x \neq \pm \frac{1}{2}, \quad f(x) = \frac{3x}{4x^2 - 1} \quad (1)$$

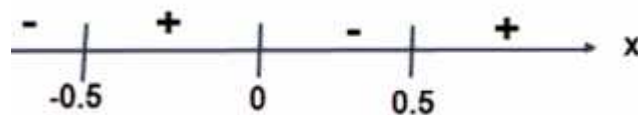
$$f'(x) = 3 \cdot \frac{4x^2 - 1 - x \cdot 8x}{(4x^2 - 1)^2}$$

$$f'(x) = 3 \cdot \frac{-4x^2 - 1}{(4x^2 - 1)^2}$$

$$x < -\frac{1}{2}, \quad -\frac{1}{2} < x < \frac{1}{2}, \quad x > \frac{1}{2} \quad (2)$$

$$x < 0, \quad x > 0$$

$$-\frac{1}{2} < x < \frac{1}{2}, \quad x < -\frac{1}{2}, \quad x > \frac{1}{2}$$



$$x < -\frac{1}{2}, \quad 0 < x < \frac{1}{2}, \quad -\frac{1}{2} < x < 0, \quad x > \frac{1}{2}$$

$$f(x), \quad g(x) = \sqrt{\frac{3x}{4x^2 - 1}}$$

$$f(x), \quad f(x) \quad (1)$$

$$-\frac{1}{2} < x \leq 0, \quad x > \frac{1}{2}$$

$$g(x) \quad (2)$$

$$x = -\frac{1}{2}, \quad x = \frac{1}{2}, \quad x = \pm \frac{1}{2}$$

$$0, \quad (1) \quad (2) \quad x \rightarrow +\infty$$

$$\sqrt{0} = 0$$

$$x \rightarrow +\infty, \quad y = 0 - y, \quad x = -\frac{1}{2}, \quad x = \frac{1}{2} : x$$

$x < 0$,

$$g(x) = \sqrt{\frac{3x}{4x^2 - 1}} = \sqrt{f(x)}$$

$f(x)$,

$g(x)$,

$$g'(x) = \frac{f'(x)}{2\sqrt{f(x)}} \quad (1)$$

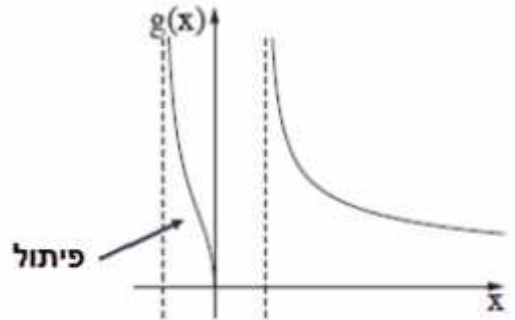
()

$-\frac{1}{2} < x \leq 0$, $x > \frac{1}{2}$

$g(x)$ -

$x \rightarrow +\infty$ $y = 0$ - y -

$x = -\frac{1}{2}$ - $x = \frac{1}{2}$: x -



$g(x)$

(2)

$x = 0$, $-\frac{1}{2} < x < 0$, $x > \frac{1}{2}$

$x = -\frac{1}{2}$ - , $x = 0$, $x = \frac{1}{2}$: x -

$g'(x) < 0$

(\cap)

(\cup)

$g(x)$

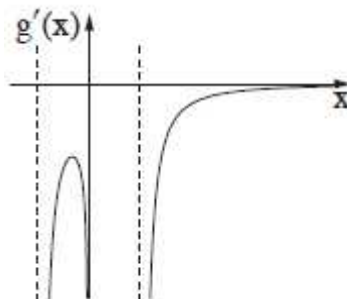
$x < 0$,

$g'(x)$

$y = 0$

$g'(x)$, (\cup)

$g(x)$ $x > \frac{1}{2}$



()

$$h(x) = \frac{\sqrt{3x}}{\sqrt{4x^2 - 1}}$$

$4x^2 - 1 > 0$ $x \geq 0$,

$x > \frac{1}{2}$

$(0 < t < 1) \quad x = t \quad , \quad y = -x^2 + 1$

$(t, -t^2 + 1) \quad t -$

$y' = -2x \rightarrow m = -2t :$

$y - (-t^2 + 1) = -2t(x - t) \rightarrow y = -2tx + 2t^2 - t^2 + 1 \rightarrow \boxed{y = -2tx + t^2 + 1} :$

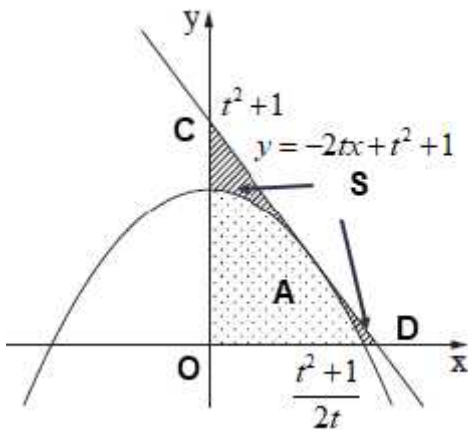
$y = -2tx + t^2 + 1 :$

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ΔCOD

$x_C = 0 \rightarrow y_C = t^2 + 1$

$y_D = 0 \rightarrow 0 = -2tx + t^2 + 1 \rightarrow 2tx = t^2 + 1 \rightarrow x_D = \frac{t^2 + 1}{2t}$



$f(t) = \frac{1}{2} \left(\frac{t^2 + 1}{2t} \right) (t^2 + 1)$

$\boxed{f(t) = \frac{1}{4} \cdot \frac{(t^2 + 1)^2}{t}}$

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

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

$\boxed{f'(t) = \frac{1}{4} \cdot \frac{(t^2 + 1) \cdot (3t^2 - 1)}{t^2}}$

$3t^2 - 1 = 0$

$t = \pm \frac{\sqrt{3}}{3} \rightarrow \boxed{t = \frac{\sqrt{3}}{3}} \leftarrow 0 < t < 1$

$(3t^2 - 1) \quad , \quad (t^2 + 1)$

$t = \frac{\sqrt{3}}{3} \quad ,$

$t = \frac{\sqrt{3}}{3} - ,$

$S \quad t = \frac{\sqrt{3}}{3} :$

