

место для  
скобки

Шифр **09300**

Открытая региональная межвузовская олимпиада вузов Томской области (ОРМО)

Общий балл	Дата	Ф.И.О. членов жюри	Подписи членов жюри
53			<i>Александр</i>

1)  $\Gamma_1 = \frac{A'D'}{AD}$   
 $\Gamma_2 = \frac{B'C'}{BC}$   
 $BC = 2AD$

$\Rightarrow \frac{\Gamma_1}{\Gamma_2} = \frac{A'D'}{B'C'} \cdot \frac{2AD}{AD} = 2 \frac{A'D'}{B'C'}$   
 $B'C' = 2AD \cdot \frac{\Gamma_1}{\Gamma_2} = \frac{20}{3} AD$

2)  $\frac{1}{F} = \frac{1}{d_{AD}} + \frac{1}{f_{AD}}$   
 $\frac{1}{F} = \frac{1}{d_{BC}} + \frac{1}{f_{BC}}$

$\Rightarrow \frac{1}{d_{AD}} + \frac{1}{\Gamma_1 d_{AD}} = \frac{1}{d_{BC}} + \frac{1}{\Gamma_2 d_{BC}}$

$\Gamma_2 = \frac{f_{BC}}{d_{BC}} ; \Gamma_1 = \frac{f_{AD}}{d_{AD}} \Rightarrow f_{BC} = \Gamma_2 \cdot d_{BC} ; f_{AD} = \Gamma_1 \cdot d_{AD}$

$\frac{d_{BC}}{d_{AD}} \left( 1 + \frac{1}{\Gamma_1} \right) = 1 + \frac{1}{\Gamma_2} \Rightarrow \frac{d_{BC}}{d_{AD}} = \frac{1 + \frac{1}{\Gamma_2}}{1 + \frac{1}{\Gamma_1}} = \frac{5}{4} : \frac{11}{6} = \frac{15}{22}$

~~$f_{AD} = \frac{1}{2} (AD + BC) \cdot DC = \frac{1}{2} \cdot 3AD \cdot DC$~~

~~$\frac{f_{BC}}{f_{AD}} = \frac{\Gamma_2}{\Gamma_1} \cdot \frac{d_{BC}}{d_{AD}} = \frac{4}{12} \cdot \frac{15}{22} = \frac{25}{11}$~~

$\frac{DC}{DC'} = \frac{d_{AD} - d_{BC}}{f_{AD} - f_{BC}} = \frac{d_{AD} - \frac{15}{22} d_{AD}}{\frac{1}{2} \cdot 3AD - \frac{25}{11} \cdot \frac{1}{2} \cdot 3AD} = \frac{d_{AD} \left( 1 - \frac{15}{22} \right)}{\frac{3}{2} AD \left( 1 - \frac{25}{11} \right)} = \frac{1}{\Gamma_1} \cdot \frac{7 \cdot 11}{22 \cdot 11} = \frac{245}{226}$

здесь манус означаем  $\frac{DC}{DC'}$  как  $\frac{S_2}{S_1}$

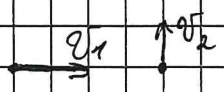
$\frac{S_1}{S_2} = \frac{\frac{1}{2} \cdot (AD + 2AD) \cdot DC}{\frac{1}{2} \cdot (AD' + \frac{20}{3} AD') \cdot DC'} = \frac{3 AD \cdot \frac{245}{726}}{\frac{23}{3} AD' \cdot \frac{1}{\Gamma_1}} = \frac{8 \cdot 245}{23 \cdot 726} \cdot \frac{1}{\Gamma_1} = 0,092$

$\frac{S_2}{S_1} = 20,90481633 \approx 20,90$  Ответ: 20,90

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1/2

1 случай:



$$8 - v_1 t - \frac{v_1 t^2}{2} \geq 1$$

$$v_2 t + \frac{v_2 t^2}{2} = 10$$

$$7 \geq v_1 t + 10 - v_2 t$$

$$t \leq \frac{7-10}{v_1 - v_2} = \frac{-3}{-2} = \frac{3}{2}$$

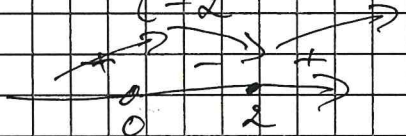
$$t \leq \frac{3}{2}$$

$$a = \frac{d}{dt} \left( 10 - v_2 t \right) \frac{2}{t^2} = \frac{20}{t^2} (1-t)$$

$$a' = -\frac{40}{t^3} (1-t) - \frac{20}{t^2} = 0$$

$$\frac{2(1-t) + t}{t^3} = 0$$

$$t \neq 0$$
$$t = 2$$

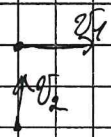


$$a_{min} = \frac{20}{(2)^2} \left( 1 - \frac{2}{2} \right) = \frac{20 \cdot 4}{9} \cdot \left( -\frac{1}{2} \right) = -\frac{40}{9} = -4\frac{4}{9}$$

$$|a_{min}| = 4\frac{4}{9} \text{ м/с}^2$$

100

2 случай:



$$10 - v_2 t - \frac{v_2 t^2}{2} \geq 1$$

$$v_1 t + \frac{v_1 t^2}{2} = 8$$

$$9 \geq v_2 t + 8 - v_1 t$$

$$t \leq \frac{1}{v_2 - v_1} = \frac{1}{2}$$

$$t \leq \frac{1}{2}$$

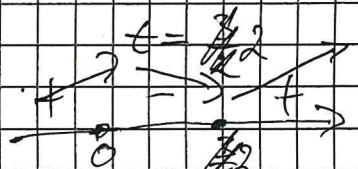
$$a = \frac{d}{dt} \left( 8 - v_1 t \right) \frac{2}{t^2}$$

$$a = \frac{16}{t^2} (1-t)$$

$$a' = -\frac{32}{t^3} (1-t) - \frac{16}{t^2} = 0$$

$$\frac{2(1-t) + t}{t^3} = 0$$

$$t \neq 0$$



$$a_{min} = \left( 8 - 8 \cdot \frac{1}{2} \right) \frac{2}{\left( \frac{1}{2} \right)^2}$$

$$= \frac{1}{2} \cdot 8 \cdot 2 \cdot 4 = 32$$



3

~~$C_{air}(t_2 - t_1) = 3 C_b(t - t_2)$~~

~~$C_{air}(t' - t) = 4 C_b(t' - t_1)$~~

~~$C_{air}(t' - t) = C_b(4t' - 4t_1 + 3t - 3t_2)$~~

~~$C_{air}(t' - t) = C_b(4t' - 4t_1 + 3t - 3t_2)$~~

~~$C_{air}(t' - t) = C_b(4t' - 4t_1 + 3t - 3t_2)$~~

~~$C_{air}(t'' - t) = 3 C_b(t'' - t)$~~

~~$C_{air}(t''' - t'') = 4 C_b(t''' - t')$~~

~~$C_{air}(t''' - t) = C_b(4t''' - 4t' - 3t'' - 3t)$~~

~~$C_{air}(t''' - t_1) = C_b(4t''' - 4t_1 + 3t'' - 3t_2)$~~

3

~~$C_{air}(t_{x2} - t_{x1}) = 3 C_b(t_{x2} - t_{x1})$~~  +  
 ~~$C_{air}(t_{x2} - t_{x1}) = 4 C_b(t_{x2} - t_{x1})$~~  +

2)  ~~$C_{air}(t_{x3} - t_{x2}) = 3 C_b(t_{x3} - t_{x2})$~~  +  
 ~~$C_{air}(t_{x3} - t_{x2}) = 4 C_b(t_{x3} - t_{x2})$~~  +

(1)  ~~$C_{air}(t_{x2} - t_{x1}) = C_b(3t_{x2} - 3t_{x1} + 4t_{x2} - 4t_{x1})$~~  +

(2)  ~~$C_{air}(t_{x3} - t_{x2}) = C_b(3t_{x3} - 3t_{x2} + 4t_{x3} - 4t_{x2})$~~  +

~~$C_{air}(t_{x3} - t_{x1}) = C_b(3t_{x3} - 3t_{x1} + 4t_{x3} - 4t_{x1})$~~

пока 20 градусов:  ~~$C_{air}(t_{x3} - t_{x1}) = 3 C_b(3t_{x3} - 3t_{x1} + 4t_{x3} - 4t_{x1})$~~

~~$t_{x3} - t_{x1} = 5^\circ C$~~

~~$C_{air}(t_{x3} - t_{x1}) = 3 C_b(3(t_{x3} - 5) - 3 \cdot 10 + 4t_{x3} - 4t_{x1})$~~

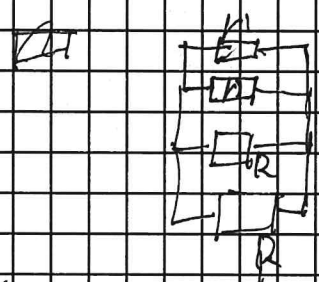
~~$C_{air}(t_{x3} - t_{x1}) = 3 C_b(3(t_{x3} - 5) - 3 \cdot 10 + 4t_{x3} - 4t_{x1})$~~

105

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$R \sim L$  — галка проволоки

сопротивление между А и В это сопротивление  
 цепи галкой так как кабель согнут, то малые отрезки  
 их длина равна.  
 эквивалентная схема



$C$  — галка кабеля

$R = \frac{L}{3} R$  м.к  $R \sim L$ ;  $X = \frac{L}{3} R$

$$R_0 = \frac{\frac{L}{3} R \cdot \frac{L}{3} R}{\frac{L}{3} R + \frac{L}{3} R} = \frac{R L^2}{(R+R)L^2}$$

~~$R_0 \neq R$~~   $R \sim L \Rightarrow R_{кабеля} = \alpha \cdot C$

$R = \alpha \cdot \frac{2}{3} C$

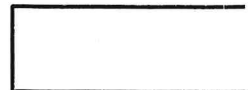
$$R_0 = \frac{\alpha \cdot \frac{2}{3} C \cdot \alpha \cdot \frac{1}{3} C}{2 \left( \alpha \cdot \frac{2}{3} C + \alpha \cdot \frac{1}{3} C \right)}$$

$$= \frac{\frac{2}{9} \alpha^2 C^2}{2} = \frac{\alpha^2 C^2}{9}$$

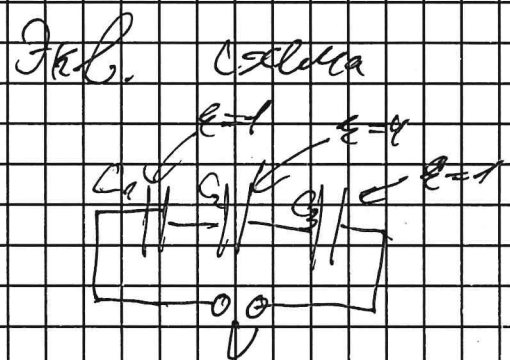
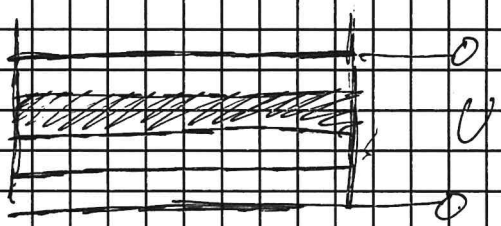
$$\frac{R_0}{R_{кабеля}} = \frac{2C}{9 \cdot \alpha C} = \frac{1}{9} = 0,11$$

Отсюда  $\alpha = 0,11$  — 100





№5



$$U = \frac{q}{C_1} + \frac{q}{C_2} + \frac{q}{C_3}$$

$$C_1 = \frac{\epsilon \epsilon_0 S}{d} = \epsilon_0 k L$$

$$C_2 = \frac{\epsilon \epsilon_0 k L}{d_1} = \frac{\epsilon \epsilon_0 (kL)^2}{U}$$

$$U = kL d_1 \Rightarrow d_1 = \frac{U}{kL}$$

$$C_3 = \frac{\epsilon_0 (kL)}{(k-d-\frac{U}{kL})}$$

$$U = q \left( \frac{dL}{\epsilon_0 k L} + \frac{U}{\epsilon \epsilon_0 k L} + \frac{\epsilon_0 k L}{k-d-\frac{U}{kL}} \right)$$

$$U = U_0 + dU \Rightarrow U_0 = U - 25 \text{ мВ}$$