AP Calculus BC
2000 Student Samples

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A,

Work for problem 2(a)

Runner A

$m = \frac{10-0}{3-0} = \frac{10}{3}$

$y - 10 = \frac{10}{3}(t-3)$

$v(t) = \frac{10}{3}t$

$v(2) = \frac{10}{3}(2)$

$= 6.667 \text{ m/s}$

Runner B

$v(t) = \frac{24t}{2t+3}$

$v(2) = \frac{24(2)}{2(2)+3}$

$= 6.857 \text{ m/s}$

Work for problem 2(b)

Runner A

$v(t) = \frac{10}{3}t$

$v(t) = v'(t) = \frac{10}{3}$

$a(2) = 3.333 \text{ m/s}^2$

Runner B

$v(t) = \frac{24t}{2t+3}$

$a(t) = v'(t) = \frac{(2t+3)(24) - (2)(24t)}{(2t+3)^2}$

$= \frac{48t + 72 - 48t}{(2t+3)^2}$

$= \frac{72}{(2t+3)^2}$

$a(2) = \frac{72}{(2(2)+3)^2}$

$= \frac{72}{49} = 1.469 \text{ m/s}^2$

Continue problem 2 on page 7.

2 2 2 2 2 2 2 2 2 2

A_2

Work for problem 2(c)

Runner A

Total Distance $= \int_0^{10} v(t)\,dt$

$= \int_0^3 \left(\frac{10}{3}t\right) dt + \int_3^{10} (10)\,dt$

$= 15_m + 70_m$

$= 85\text{ m}$

Runner B

Total Distance $= \int_0^{10} v(t)\,dt$

$= \int_0^{10} \left(\frac{24t}{2t+3}\right) dt$

$= 83.336\text{ m}$

C,

Work for problem 2(a)

a. Velocity of Runner A =
(0,0) (3,10)

$\frac{10-0}{3-10} = 10/3 = m$

(3,10) (2,y) =

$\frac{y-10}{2-3} = 10/3$

= 6.67 m/J

velocity of runner b

b. $v(t) = \frac{24t}{2t+3}$

$v(2) = \frac{(24)(2)}{2(2)+3}$

= 6.857 m/J

Work for problem 2(b)

a Runner A = ?

$v/t = a$

$V_a = 6.67 m/J$

$t = 2 J$

$\frac{6.67}{2} = 3.33 \text{ m/J}^2$

acceleration runner A

a of runner b = ?

$a = v/t$

$v = 6.857 m/J$

$t = 2S$

$\frac{6.857}{2} = 3.4285$

3.4285 m/J² acceleration of runner B

Continue problem 2 on page 7.

2 2 2 2 2 2 2 2 2 2

C_2

Work for problem 2(c)

Runner A

$d = vt$

area under curve

from 0, 10

$= \frac{1}{2}(3 \cdot 10) + 7(10)$

85 m

Runner A

Runner B

$\int v(t) = d(t)$

$\int_0^{10} \frac{24t}{2t+3} =$

83.336 m

Runner B

=

GO ON TO THE NEXT PAGE.

F1

Work for problem 2(a)

Runner A graph : $v(t)$ =

Runner B $v(t) = \frac{24t}{2t+3}$

Runner A

from the graph $v(2) = 7$ m/s

Runner B

$$v(2) = \frac{24(2)}{2(2)+3}$$

$$= \frac{48}{7}$$

$$= 6.85 \text{ m/s}$$

Work for problem 2(b)

Runner A

(2,7) & (3,10)

acceleration

$$\frac{\Delta v}{\Delta t} = \frac{10-7}{3-2}$$

$$= 3 \text{ m/s}^2$$

Runner B

$$v(t) = \frac{24t}{2t+3}$$

$$a(t) = \frac{(24)(2t+3) - (24t)(2)}{(2t+3)^2}$$

$$= \frac{48t + 72 - 48t}{(2t+3)^2}$$

$$a(2) = \frac{72}{(2(2)+3)^2}$$

$$= \frac{72}{(7)^2}$$

$$= 1.47 \text{ m/s}^2$$

Continue problem 2 on page 7.

F_2

Work for problem 2(c)

Total distance covered by Runner A = area under the v-t graph

$$= \frac{1}{2}\left(\frac{5}{\cancel{15}}\right)(3) + (7)(10)$$

$$= 15 + 70$$

$$= 85\ m$$

Total distance covered by Runer B $= \int_0^{10} v(t)\,dt$

$$= \int_0^{10} \frac{24t}{2t+3}\,dt$$

$$= 83.3\ m$$