



AP Calculus BC 2000 Student Samples

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Work for problem 2(a)

Runner A

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

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

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

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

$$= 6.667 \text{ m/s}$$

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

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

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

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

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.

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A₂

Work for problem 2(c)

Runner A

$$\begin{aligned}\text{Total Distance} &= \int_0^{10} v(t) dt \\ &= \int_0^3 \left(\frac{10}{3}t\right) dt + \int_3^{10} (10) dt \\ &= 15\text{m} + 70\text{m} \\ &= \boxed{85\text{m}}\end{aligned}$$

Runner B

$$\begin{aligned}\text{Total Distance} &= \int_0^{10} v(t) dt \\ &= \int_0^{10} \left(\frac{24t}{2t+3}\right) dt \\ &= \boxed{83.336\text{m}}\end{aligned}$$

Work for problem 2(a)

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

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

(3,10) (2,4) =

$$\frac{10-4}{3-2} = 10/3$$

$$= 6.67 \text{ m/s}$$

velocity of runner b

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

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

$$= 6.857 \text{ m/s}$$

Work for problem 2(b)

a. Runner A = ?

$$v/t = a$$

$$v_a = 6.67 \text{ m/s}$$

$$t = 2 \text{ s}$$

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

acceleration of runner A

a of runner b = ?

$$a = v/t$$

$$v = 6.857 \text{ m/s}$$

$$t = 2 \text{ s}$$

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

$$3.4285 \text{ m/s}^2$$

acceleration of runner b

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.

Work for problem 2(a)

Runner A
graph: $v(t)$

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

Runner A

from the graph: $v(2) = 7 \text{ m/s}$

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

$$\text{at } t=2 = \frac{10-7}{3-2}$$

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

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.

2 2 2 2 2 2 2 2 2 2

F₂

Work for problem 2(c)

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

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

$$= 15 + 70$$

$$= 85 \text{ m}$$

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

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

$$= 83.3 \text{ m}$$

Handwritten scribbles and notes, including the expression $\frac{24t}{2t+3}$.