Multiple Choice

calculator

1. The velocity of a particle moving on a line at time t is $v = 5t^{\frac{2}{3}} + 6t$. How many meters did the particle travel from $t = 1$ to $t = 8$?

(A) $-\frac{10}{3}$ (B) 224 (C) 279

(D) 282 (E) 533

$$\text{distance} = \int_1^8 |v(t)|\,dt = 282$$

2. The position of the particle is given as $x(t) = \cos(3t) - \sin(4t)$. Find the acceleration at $t = 0$.

(A) -9 (B) 0 (C) 1

(D) 2 (E) 16

$$s(t) = x(t) = \cos(3t) - \sin(4t)$$
$$v(t) = x'(t) = -3\sin 3t - 4\cos 4t$$
$$a(t) = x''(t) = -9\cos 3t + 16\sin 4t$$

$$a(0) = x''(0) = -9\cdot\cos(0) + 16\sin(0)$$
$$= -9\cdot 1 + 16\cdot 0$$
$$= -9$$

3. A particle moves along the x-axis with acceleration at any time t given as $a(t) = 3t^2 + 4t + 6$. If the particle's initial velocity is 10 and its initial position is 2, what is the position function?

(A) $x(t) = \frac{1}{4}t^4 + \frac{2}{3}t^3 + 3t^2 + 12$ (B) $x(t) = \frac{1}{4}t^4 + \frac{2}{3}t^3 + 3t^2 + 10t + 2$

(C) $x(t) = 3t^4 + t^3 + t^2 + 10t + 2$ (D) $x(t) = 3t^4 + t^3 + t^2 + 2$

(E) $x(t) = \frac{1}{4}t^4 + \frac{2}{3}t^3 + 3t^2 + 2$

$$v(t) = \int a(t)\,dt + 10 = t^3 + 2t^2 + 6t + 10$$

then

$$s(t) = \int v(t)\,dt + 2 = \frac{1}{4}t^4 + \frac{2}{3}t^3 + 3t^2 + 10t + 2$$

4. If the position of an ant traveling along a horizontal path at time t is $3t^2 + 1$, what is the ant's average velocity from $t = 1$ to $t = 6$?

$s(t)$

(A) $\frac{1}{21}$ (B) 6 (C) $\frac{109}{6}$

(D) 21 (E) 220

$$\text{av. vel.} = \frac{1}{6-1}\int_1^6 v(t)\,dt$$
$$= \frac{1}{5}\left(3t^2+1\right)\Big]_1^6$$
$$= \frac{1}{5}\left[(109) - (4)\right]$$
$$= \frac{1}{5}\left[105\right]$$
$$= 21$$

The following information applies to problems 5, 6 and 7.

A bottle rocket is shot upward from a 10 foot stand with velocity $v(t) = 50 - 1.6t$.

5.GC What is the position of the bottle rocket after 2 seconds?

(A) 46.8 ft (B) 56.8 ft (C) 96.8 ft

(D) 103.6 ft (E) 106.8 ft

position $s(t) = \int_0^2 v(t)\,dt + 10$

$= 50t - 0.8t^2 \Big]_0^2 + 10$

calculator $= 106.8$

6.GC When will the bottle rocket hit the ground?

(A) $t = 0$ (B) $t = 8.66$ (C) $t = 31.448$

(D) $t = 62.5$ (E) $t = 62.699$

set $s(t) = 0$

graph + find zeros

7.GC After 3 seconds the rocket is

(A) falling at an increasing rate
(B) rising at an increasing rate
(C) rising at a decreasing rate
(D) falling at a decreasing rate
(E) rising a constant rate

$v(3) =$ positive #

$a(3) =$ negative #

8. The position of the particle traveling along a straight line is $x(t) = t^3 - 9t^2 + 15t + 3$. On the interval $t = 0$ to $t = 10$, when is the particle farthest to the left?

(A) $t = 0$ (B) $t = 1$ (C) $t = 3$

(D) $t = 5$ (E) $t = 10$

left when $v(t) < 0$

$v(t) = 3t^2 - 18t + 15 = 0$

$3(t^2 - 6t + 5) = 0$

$3(t-5)(t-1) = 0$

$t = 1, 5$

$v(t)$: + on $(0,1)$, − on $(1,5)$, + on $(5,10)$

9.GC Choose the integral expression that would result in the total distance traveled on the interval [0, 3] if the velocity is given by $v(t) = e^t - 6$.

(A) $\int_0^{\ln 6}(e^t-6)\,dt + \int_{\ln 6}^3 (e^t-6)\,dt$

(B) $\int_3^{\ln 6}(e^t-6)\,dt - \int_{\ln 6}^0 (e^t-6)\,dt$

(C) $\int_{\ln 6}^3 (e^t-6)\,dt - \int_0^{\ln 6}(e^t-6)\,dt$

(D) $\int_0^{\ln 6}(e^t-6)\,dt - \int_{\ln 6}^3 (e^t-6)\,dt$

(E) $\int_0^3 (e^t-6)\,dt$

distance $= \int |v(t)|\,dt$

set $v(t) = 0$

$e^t - 6 = 0$

$e^t = 6$

$t = \ln 6$

$\int_0^{\ln 6} |v(t)|\,dt + \int_{\ln 6}^3 |v|\,dt = \int_{\ln 6}^3 v - \int_0^{\ln 6} v$

neg pos

10.GC When two particles start at the origin with velocities $v(t) = 4\cos t$ and $v(t) = 4\sin t$, how many times in the interval $[0, 2\pi]$ will their speeds be equal?

(A) 2 (B) 3 (C) 4

(D) 5 (E) 6

speed $= |v(t)|$

$|4\cos t| = |4\sin t|$

$|\cos t| = |\sin t|$

$t = \pi/4, 5\pi/4, 3\pi/4, 7\pi/4$