Particle Motion Practice

The **POSITION** of a moving particle on a coordinate line is given by the function,
$$s(t) = -t^3 - 4t^2 + 60t$$
where t is measured in minutes and s(t) is inches.

The **VELOCITY** of a particle is
$$v(t) = -3t^2 - 8t + 60$$
where t is measured in minutes and v(t) is inches per minute.

The **ACCELERATION** of a particle is
$$a(t) = -6t - 8$$
where t is measured in minutes and a(t) is inches per minute squared.

$s(0) = -(0)^3 - 4(0)^2 + 60(0) = 0$

$v(t) = 0 \quad -3t^2 - 8t + 60 = 0$

$t^2 - 8t - 180 = 0$

-18×10
$-18 \quad 10$
-8

$(t-18)(t+10) = 0$

$\dfrac{}{-3} \quad \dfrac{}{-3}$

$t = -6, \quad t = 10/3 \quad (t+6)(-3t+10) = 0$

Answer the following questions about a particle that moves on a horizontal coordinate line.

1. Where does the particle start?
   Particle starts at x = 0

2. When is does the particle stop?
   Particle stop after 10/3 mins.

3. Where does the particle stop?
   Particle stops at x = 118.519

4. When is the particle moving to the right/left?
   Right: [0, 10/3)   Left: (10/3, ∞)

5. When is the particle speeding up/ slowing down?

$S(10/3) = -(10/3)^2 - 4(10/3) + 60(10/3) \approx 118.519$

$v(t)$ ├+++++++++┤- - - - →

$\downarrow \quad 10/3 \quad \uparrow$

$a(t)$ ├- - - - - - - - →

speeding up (10/3, ∞) slowing down [0, 10/3)

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The **POSITION** of a moving particle on a coordinate line is given by the function,

$$s(t) = -t^4 + 8t^3$$

where t is measured in minutes and s(t) is inches.

The **VELOCITY** of a particle is

$$v(t) = -4t^3 + 24t^2$$

where t is measured in minutes and v(t) is inches per minute.

The **ACCELERATION** of a particle is

$$a(t) = -12t^2 + 48t$$

where t is measured in minutes and a(t) is inches per minute squared.

- $s(0) = -(0)^4 + 8(0)^3$
- $v(t) = 0 \quad -4t^3 + 24t^2 = 0$

$$-4t^2(t-6) = 0$$
$$t = 0 \quad t = 6$$

Answer the following questions about a particle that moves on a horizontal coordinate line.

- 1. Where does the particle start?

  The Particle starts at x=0

- 2. When is does the particle stop?

  The Particle starts at rest and stops after 6 mins.

- 3. Where does the particle stop?

  The Particle is stopped at x=0 and x=432

4. When is the particle moving to the right/left?

  Right: (0,6) Left (6,∞)

5. When is the particle speeding up/ slowing down?

- $s(0) = -(0)^4 + 8(0)^3 = 0 \qquad s(6) = -(6)^4 + 8(6)^3 = 432$

- $v(t)$ |++++++++|- - - - - - →
         ↑   ↓6   ↑

- $a(t)$ |+++++|- - - - - - →
              4

  speed up: (0,4)∪(6,∞)
  slow down: (4,6)

  $a(t) = 0 \rightarrow -12t^2 + 48t = 0$
  $-12t(t-4) = 0$
  $t = 0 \quad t = 4$

The **POSITION** of a moving particle on a coordinate line is given by the function,
$$s(t) = -t^2 + 22t - 112$$
where t is measured in minutes and s(t) is inches.

The **VELOCITY** of a particle is
$$v(t) = -2t + 22$$
where t is measured in minutes and v(t) is inches per minute.

The **ACCELERATION** of a particle is
$$a(t) = -2$$
where t is measured in minutes and a(t) is inches per minute squared.

- $S(0) = -(0)^2 + 22(0) - 112 = -112$
- $v(t) = 0 \quad -2t + 22 = 0 \quad t = 11$
- $S(11) = -(11)^2 + 22(11) - 112 = 9$

Answer the following questions about a particle that moves on a horizontal coordinate line.

1. Where does the particle start?
   the Particle starts at $x = -112$

2. When is does the particle stop?
   the Particle stops after 11 mins.

3. Where does the particle stop?
   the Particle stops at $x = 9$

4. When is the particle moving to the right/left?
   Right $[0, 11)$ Left $(11, \infty)$

5. When is the particle speeding up/ slowing down?

$v(t)$ |+++++++++

$a(t)$
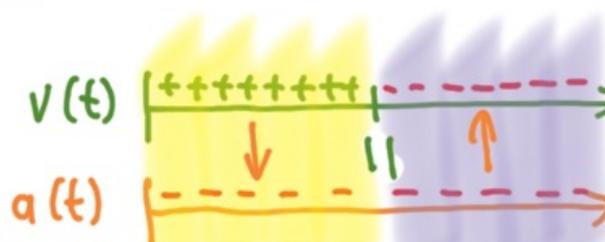
speeding up $(11, \infty)$ slowing down $[0, 11)$

The **POSITION** of a moving particle on a coordinate line is given by the function,
$$s(t)=t^3-13t^2$$
where t is measured in minutes and s(t) is inches.

The **VELOCITY** of a particle is
$$v(t)=3t^2-26t$$
where t is measured in minutes and v(t) is inches per minute.

The **ACCELERATION** of a particle is
$$a(t)=6t-26$$
where t is measured in minutes and a(t) is inches per minute squared.

$$s(0)=(0)^3-13(0)^2=0$$

$$v(t)=0 \rightarrow 3t^2-26t=0$$
$$t(3t-26)=0$$
$$t=0 \quad t=\tfrac{26}{3}$$

Answer the following questions about a particle that moves on a horizontal coordinate line.

1. Where does the particle start?

The particle starts at $x=0$

2. When is does the particle stop?

The particle starts at rest and stops at $x=\tfrac{26}{3}$

3. Where does the particle stop?

The particle is stopped at $x=0$ and $x=-325.481$

4. When is the particle moving to the right/left?

Right $(\tfrac{26}{3},\infty)$ Left $(0,\tfrac{26}{3})$

5. When is the particle speeding up/ slowing down?

$$v(0)=(0)^3-13(0)^2=0 \quad v(\tfrac{26}{3})=(\tfrac{26}{3})^3-13(\tfrac{26}{3})^2\approx$$

$$-325.481$$

$v(t)$ ... $\tfrac{26}{3}$ +++++ →

$a(t)$ ... $\tfrac{26}{6}$ +++++++ → slowing down $(\tfrac{26}{6},\tfrac{26}{3})$

speeding up: $(0,\tfrac{26}{6})\cup(\tfrac{26}{3},\infty)$