
CALCULUS: KINEMATICS (TOTAL DISTANCE TRAVELLED)**Best Guess Mastery Worksheet (Target Grade 8/9)****I Do**

23. A particle P moves along a straight line.

The displacement, s metres, of P from a fixed point O at time t seconds is given by

$$s = t^3 - 12t^2 + 45t$$

Find the total distance travelled by the particle in the first 7 seconds of its motion.

Answer = m

CALCULUS: KINEMATICS (TOTAL DISTANCE TRAVELLED)**Best Guess Mastery Worksheet (Target Grade 8/9)****We Do**

A particle Q moves along a straight line.

The displacement, s metres, of Q from a fixed point O at time t seconds is given by

$$s = t^3 - 9t^2 + 24t$$

Find the total distance travelled by the particle in the first 5 seconds of its motion.

Answer = m

CALCULUS: KINEMATICS (TOTAL DISTANCE TRAVELLED)**Best Guess Mastery Worksheet (Target Grade 8/9)****You Do 1**

A particle R moves along a straight line.

The displacement, s metres, of R from a fixed point O at time t seconds is given by

$$s = t^3 - 6t^2 + 9t$$

Find the total distance travelled by the particle in the first 4 seconds of its motion.

Answer = m

CALCULUS: KINEMATICS (TOTAL DISTANCE TRAVELLED)**Best Guess Mastery Worksheet (Target Grade 8/9)****You Do 2**

A particle A moves along a straight line.

The displacement, s metres, of A from a fixed point O at time t seconds is given by

$$s = 2t^3 - 15t^2 + 36t$$

Find the total distance travelled by the particle in the first 4 seconds of its motion.

Answer = m

CALCULUS: KINEMATICS (TOTAL DISTANCE TRAVELLED)**Best Guess Mastery Worksheet (Target Grade 8/9)****Challenge 1**

A particle B moves along a straight line.

The displacement, s metres, of B from a fixed point O at time t seconds is given by

$$s = t^3 - 10.5t^2 + 30t$$

Find the total distance travelled by the particle in the first 6 seconds of its motion.

Answer = m

CALCULUS: KINEMATICS (TOTAL DISTANCE TRAVELLED)**Best Guess Mastery Worksheet (Target Grade 8/9)****Challenge 2**

A particle C moves along a straight line.

The displacement, s metres, of C from a fixed point O at time t seconds is given by

$$s = t^3 - 7.5t^2 + 12t$$

Find the total distance travelled by the particle in the first 5 seconds of its motion.

Answer = m

Answers & Worked Solutions

I Do:

1. Differentiate to find velocity: $v = ds/dt = 3t^2 - 24t + 45$.
2. Set $v = 0$ to find turning points: $3(t^2 - 8t + 15) = 0 \rightarrow 3(t - 3)(t - 5) = 0 \rightarrow$ turns at $t = 3$, $t = 5$.
3. Find displacements at $t = 0, 3, 5, 7$:
 $s(0) = 0$
 $s(3) = (3)^3 - 12(3)^2 + 45(3) = 27 - 108 + 135 = 54 \text{ m}$
 $s(5) = (5)^3 - 12(5)^2 + 45(5) = 125 - 300 + 225 = 50 \text{ m}$
 $s(7) = (7)^3 - 12(7)^2 + 45(7) = 343 - 588 + 315 = 70 \text{ m}$
4. Calculate distances between turning points: $|54 - 0| + |50 - 54| + |70 - 50| = 54 + 4 + 20 = 78 \text{ m}$

We Do:

1. Differentiate: $v = 3t^2 - 18t + 24$.
2. Set $v = 0$: $3(t^2 - 6t + 8) = 0 \rightarrow 3(t - 2)(t - 4) = 0 \rightarrow$ turns at $t = 2, t = 4$.
3. Find displacements: $s(0) = 0, s(2) = 20, s(4) = 16, s(5) = 20$.
4. Distance: $|20 - 0| + |16 - 20| + |20 - 16| = 20 + 4 + 4 = 28 \text{ m}$

You Do 1:

1. Differentiate: $v = 3t^2 - 12t + 9$.
2. Set $v = 0$: $3(t^2 - 4t + 3) = 0 \rightarrow 3(t - 1)(t - 3) = 0 \rightarrow$ turns at $t = 1, t = 3$.
3. Find displacements: $s(0) = 0, s(1) = 4, s(3) = 0, s(4) = 4$.
4. Distance: $|4 - 0| + |0 - 4| + |4 - 0| = 4 + 4 + 4 = 12 \text{ m}$

You Do 2:

1. Differentiate: $v = 6t^2 - 30t + 36$.
2. Set $v = 0$: $6(t^2 - 5t + 6) = 0 \rightarrow 6(t - 2)(t - 3) = 0 \rightarrow$ turns at $t = 2, t = 3$.
3. Find displacements: $s(0) = 0, s(2) = 28, s(3) = 27, s(4) = 32$.
4. Distance: $|28 - 0| + |27 - 28| + |32 - 27| = 28 + 1 + 5 = 34 \text{ m}$

Challenge 1:

1. Differentiate: $v = 3t^2 - 21t + 30$.
2. Set $v = 0$: $3(t^2 - 7t + 10) = 0 \rightarrow 3(t - 2)(t - 5) = 0 \rightarrow$ turns at $t = 2, t = 5$.
3. Find displacements: $s(0) = 0, s(2) = 26, s(5) = 12.5, s(6) = 18$.
4. Distance: $|26 - 0| + |12.5 - 26| + |18 - 12.5| = 26 + 13.5 + 5.5 = \mathbf{45 \text{ m}}$

Challenge 2:

1. Differentiate: $v = 3t^2 - 15t + 12$.
2. Set $v = 0$: $3(t^2 - 5t + 4) = 0 \rightarrow 3(t - 1)(t - 4) = 0 \rightarrow$ turns at $t = 1, t = 4$.
3. Find displacements: $s(0) = 0, s(1) = 5.5, s(4) = -8, s(5) = -2.5$.
4. Distance: $|5.5 - 0| + |-8 - 5.5| + |-2.5 - (-8)| = 5.5 + 13.5 + 5.5 = \mathbf{24.5 \text{ m}}$