**Author: Tharaniya Rasakulasingham**

This step-by-step solution guide has been created by **Tharaniya Rasakulasingham** for educational purposes. While we have made every effort to ensure the accuracy of the information presented, it is possible that there may be errors or omissions. We encourage users to critically evaluate and verify the content. BF Maths and the author cannot be held responsible for any errors or inaccuracies in this guide.

If you find any mistakes or have any suggestions for improvements, please contact us at bfmathshello@gmail.com. Your feedback is invaluable in helping us maintain the quality and accuracy of our resources. Please specify *which exercise* and *which question* in the email.

Thank you for using BF Maths for your maths revision!

# Chapter 11 Problem Solving Set A

## Bronze:

a) $x = t^3 - 8t^2 + 5t$

$v = 3t^2 - 16t + 5$

$v = 0 \rightarrow 3t^2 - 16t + 5 = 0$

$t = 5 \quad t = \frac{1}{3}$

b) $\left[ t^3 - 8t^2 + 5t \right]_{1/3}^{5}$

$\left( (5)^3 - 8(5)^2 + 5(5) \right) - \left( (1/3)^3 - 8(1/3)^2 + 5(1/3) \right)$

$= (-50) - \left( \frac{22}{27} \right) = -\frac{1372}{27} = -50.8 \rightarrow 50.8\text{m}$

c) $v = 3t^2 - 16t + 5$

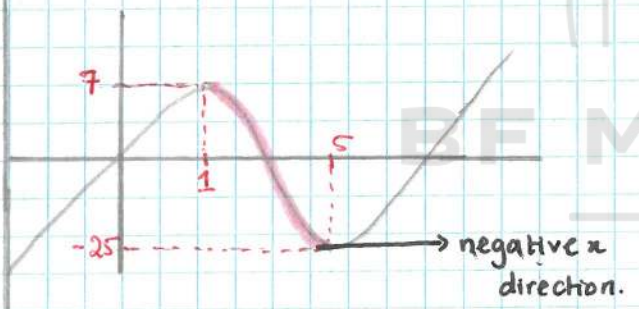
$a = \frac{dv}{dt} = 6t - 16$

$6t - 16 > 0$

$6t > 16$

$t > 8/3$

## Silver:




$x = t(t^2 - 9t + 15)$

$x = t^3 - 9t^2 + 15t$

Turning point $= \frac{dx}{dt} = 0$

$\frac{dx}{dt} = 3t^2 - 18t + 15 = 0$

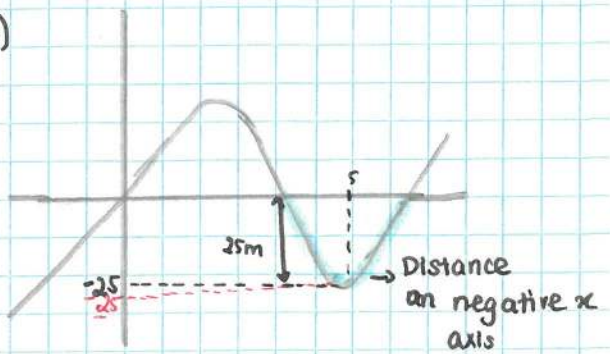
$t = 5 \quad t = 1$

$t = 5 \rightarrow x = (5)^3 - 9(5) + 15(5) = -25 \rightarrow 25\text{m}$

$t = 1 \rightarrow x = (1)^3 - 9(1) + 15(1) = 7 \rightarrow 7\text{m}$

$25\text{m} + 7\text{m} = 32\text{m}$

b)

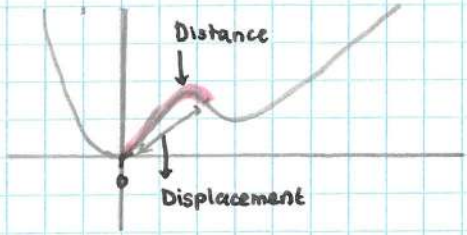



$25\text{m} \times 2 = 50\text{m}$

## Gold:

a) $x = \frac{1}{3}t^2 \left( t^2 - 6t + 10 \right)$

$t = 0$ No solution.




The line does not go below the x-axis so the particle P will never move along the negative x axis.

b)i) The particle is not moving in the same direction for the whole motion. Displacement is not the same as distance so displacement at $t = 3$ is not equal to the distance at $t = 3$.

ii) $x = \frac{1}{3}t^2 \left( t^2 - 6t + 10 \right)$

$= \frac{1}{3}t^4 - 2t^3 + \frac{10}{3}t^2$

$\frac{dx}{dt} = \frac{4}{3}t^5 - 6t^2 + \frac{20}{3}t$

$t = 5/2, \quad t = 2, \quad t = 0$

Limits $= 0, 2, 5/2, 3$

$\left[ \frac{1}{3}t^4 - 2t^3 + \frac{10}{3}t^2 \right]_0^2 = 8/3$

$\left[ \frac{1}{3}t^4 - 2t^3 + \frac{10}{3}t^2 \right]_2^{5/2} = \frac{125}{48} - \frac{8}{3} = -\frac{1}{16}$

$\left[ \frac{1}{3}t^4 - 2t^3 + \frac{10}{3}t^2 \right]_{5/2}^3 = 3 - \frac{125}{48} = \frac{19}{48}$

$\frac{8}{3} + \frac{1}{16} + \frac{19}{48} = \frac{25}{8} = 3.125\text{m}$