

MATH 1040 / 7040 ASSIGNMENT 8 SOLS

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1. a)  $y = x^2 - 4x - 12$

$$y' = 2x - 4$$

$$y'(5) = 2 \cdot 5 - 4 \\ = 6$$

$\therefore$  Ted's tangent line is  $y = 6x + c$

$$(5, -7) \Rightarrow -7 = 6 \cdot 5 + c$$

$$\therefore c = -37$$

$$\therefore y = 6x - 37$$

b)  $-7x + 15 = 6x - 37$

$$52 = 13x$$

$$\therefore x = 4$$

$$y = -13$$

So Ted hits the wall at  $(4, -13)$

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3. At least 10 lines.

2.

Let  $S_1 = -0.5t^2 + 12t$  (1) and Let  $S_2 = 0.7t^2$  (2)

(a)  $D = S_1 - S_2 = -0.5t^2 + 12t - 0.7t^2 = -1.2t^2 + 12t$  (3)

(b)  $D' = -2.4t + 12$  (4)

Let (4) equal 0 and solve for  $t$ :  $2.4t = 12 \rightarrow t = 5$ . Thus, after 5 seconds, the distance between them is a maximum.

(c) Substitute  $t = 5$  into (3), giving  $D = -1.2(5^2) + 12 \times 5 = 30$ .

Thus the maximum distance between them is 30 metres. Unfortunately for her, he will catch her.

(d)  $V_1 = S_1' = -t + 12$  and  $V_2 = S_2' = 1.4t$ .

(e) At the instant when they are separated by a maximum distance, they cannot be either getting further apart or getting closer to each other. That is, their velocities must be equal. To check, substitute  $t = 5$  into  $V_1$  and  $V_2$ :  $V_1 = V_2 = 7$ .

(f) Let the distance between them (Equation 3) equal 0 and solve for  $t$ .

Then  $-1.2t^2 + 12t = 0 \rightarrow -t(1.2t - 12) = 0 \rightarrow t = 0$  or  $10$ .

The first answer arises because they are standing together before the chase. The second answer (10 seconds) gives the time at which he catches her.