LC 2013 (Set D): Paper 1

Question 7 (40 marks)

Question 7 (a)

Tank A: At 0 s there is a depth of 25 cm in the tank. Every 10 s the depth increases by 5 cm. Therefore, after 10 s the depth is 30 cm, after 20 s it is 35 cm and so on.

Tank B: At 0 s there is a depth of 10 cm in the tank. Every 10 s the depth increases by 7.5 cm. Therefore, after 10 s the depth is 17.5 cm, after 20 s it is 25 cm and so on.

Time (s)	0	10	20	30	40	50	60	70	80	90	100	110	120
Tank A (cm)	25	30	35	40	45	50	55	60	65	70	75	80	85
Tank B (cm)	10	17·5	25	32·5	40	47·5	55	62·5	70	77·5	85	92·5	100

Marking Scheme Notes
Question 7 (a) [Scale 10D (0, 2, 5, 8, 10)]
2: • Table for one tank with two correct entries
5: • Table for one tank correct
• Table for two tanks correct for 1 minute
8: • Four terms or less missing or incorrect, allowing for consistent terms
• Tables which begin with A(10) = 25 and B(10) = 10 and continue correctly
• Tables which begin with A(0) = 0 and B(0) = 0 and continue correctly
Note 1: Accept tables which are fully correct but do not include the values at $t = 0$
Note 2: Accept answers in (b), (c) and (d) based on candidate's tables

Question 7 (b)

Tank A:
After 120 s: depth = 85 cm;
After 130 s: depth = 90 cm;
After 140 s: depth = 95 cm;
After 150 s: depth = 100 cm = 1 m;
Time: 150 s = 2 minutes, 30 seconds

Tank B:
After 120 s: depth = 100 cm = 1 m
Time: 120 s = 2 minutes

Marking Scheme Notes
Question 7 (b) [Scale 5B* (0, 2, 5)]
2: • One correct answer.
* Penalise one mark for incorrect or omitted units, provided full marks otherwise

Question 7 (c)

Tank A: What is the increase in depth every second? $\frac{5}{10}$ cm $= \frac{1}{2}$ cm

What is the depth after 20 seconds? $(25 + \frac{1}{2} \times 20)$ cm $=$ 35 cm

What is the depth after t seconds? $(25 + \frac{1}{2}t)$ cm

$$d = 25 + \tfrac{1}{2}t, \; [d = \text{depth (cm)}, \; t = \text{time (s)}]$$

Tank B: What is the increase in depth every second? $\frac{7{\cdot}5}{10}$ cm $= \frac{3}{4}$ cm

What is the depth after 20 seconds? $(10 + \frac{3}{4} \times 20)$ cm $=$ 25 cm

What is the depth after t seconds? $(10 + \frac{3}{4}t)$ cm

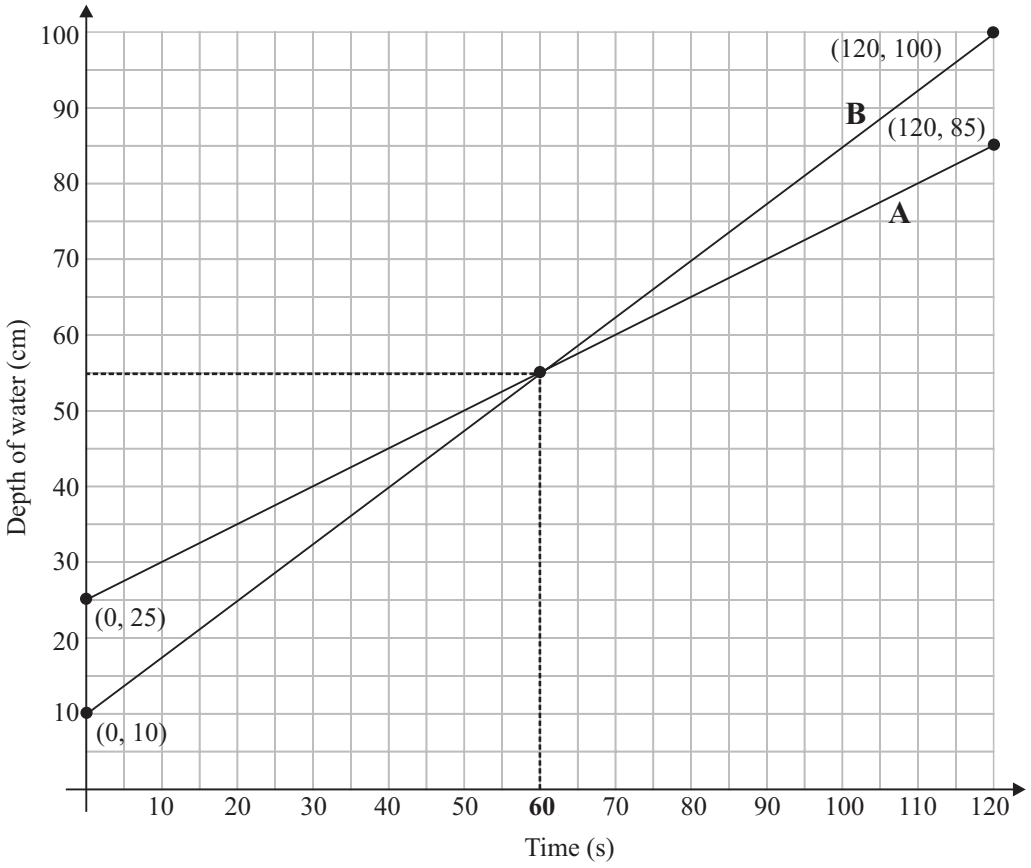
$$d = 10 + \tfrac{3}{4}t, \; [d = \text{depth (cm)}, \; t = \text{time (s)}]$$

Marking Scheme Notes
Question 7 (c) [Scale 5B (0, 2, 5)]
2: • Writes $T_n = a + (n - 1)d$
• Some work at setting up a formula

Question 7 (d)

Time (s)	**0**	10	20	30	40	50	60	70	80	90	100	110	**120**
Tank A (cm)	**25**	30	35	40	45	50	55	60	65	70	75	80	**85**
Tank B (cm)	**10**	17·5	25	32·5	40	47·5	55	62·5	70	77·5	85	92·5	**100**

The graphs are straight lines so you just need to pick 2 points from the table.
Tank A: (0, 25), (120, 85)
Tank B: (0, 10), (120, 100)



Question 7 (e)

You can find out from the graph the time when each tank has the same depth of water by finding out where the graphs intersect.

Answer: 60 seconds

Marking Scheme Notes

Question 7 (d) [Scale 10C (0, 3, 7, 10)]

3: • Correct point plotted for one line
• A line of some relevance drawn

7: • One graph fully correct or both graphs substantially correct
• Correct graphs drawn freehand
Note: Accept answers in (e) and (f) based on candidate's graph

Question 7 (e) [Scale 5B* (0, 2, 5)]

2: • Point of intersection identified
• Answer indicated on axis but value not written
* Penalise one mark for incorrect or omitted units, provided full marks otherwise

Question 7 (f)

Tank A: $d = 25 + \frac{1}{2}t$

Tank B: $d = 10 + \frac{3}{4}t$

$\therefore 25 + \frac{1}{2}t = 10 + \frac{3}{4}t$

$25 - 10 = \frac{3}{4}t - \frac{1}{2}t$

$15 = \frac{1}{4}t$

$\therefore t = 60$ s

Or substitute $t = 60$ into each formula:

Tank A: $d = 25 + \frac{1}{2}t = 25 + \frac{1}{2}(60) = 55$ m

Tank B: $d = 10 + \frac{3}{4}t = 10 + \frac{3}{4}(60) = 55$ m

Marking Scheme Notes

Question 7 (f) [Scale 5C (0, 2, 4, 5)]

2: • Formulae written but not equated

4: • Error in solving equation
• Substitutes correctly into one formula only