

Real-life graphs

Foundation and Higher tiers | Total marks: 90

Marks

- M** Method mark, for a correct method. It can be implied by a correct answer.
- A** Accuracy mark, for a correct answer. It needs the method mark before it.
- B** A mark for a correct value or statement, with or without working.
- ft** Follow through: the mark is given for using an earlier wrong answer correctly.
- oe** Or equivalent.
- [a, b]** Any value from a to b inclusive.

Questions

Q	Skill	Spec	Tier	Grade	Calculator	Marks
1	Conversion graphs	A14	Foundation	3	No	4
2	Reading a non-standard graph	A14	Foundation	3	No	3
3	Sketching a distance-time graph	A14	Foundation	3	No	3
4	Graphs of direct and inverse proportion	R14	Common	4	No	2
5	Drawing a graph from a description	A14	Foundation	4	No	3
6	Interpreting straight-line graphs	A14	Foundation	4	No	4
7	Filling containers	A14	Foundation	5	No	2
8	Inverse proportion graphs in context	A14 R14	Common	5	No	5
9	Velocity-time graphs with unknown times	A15 A14	Higher	9	No	5
10	Using a conversion graph to work out a cost	A14	Foundation	2	Yes	3
11	Hire charges: a reading, the hourly rate, a budget	A14	Foundation	3	Yes	5
12	Distance-time graphs	A14	Foundation	4	Yes	4
13	Velocity-time graphs	A15 A14 R14	Higher	6	Yes	5
14	Rates of change from a curve	A15 R15 A14	Higher	7	Yes	5
15	Area under a curve	A15	Higher	8	Yes	4
16	Area under a rate graph	A15 A14	Higher	8	Yes	6

Q	Skill	Spec	Tier	Grade	Calculator	Marks
17	Gradient of a curve by a tangent	A15 A14	Higher	8	Yes	5
18	Distance from a velocity-time description	A15 R11	Higher	8	Yes	5
19	Exponential growth from a graph	A12 R16	Higher	8	Yes	5
20	Average and instantaneous rates of change	A15 A12	Higher	9	Yes	6
21	Area under a curve and comparing speeds	A15 A14	Higher	9	Yes	6
	Total					90

Question 1 A14 · Foundation · Grade 3 · 4 marks

Q	Answer	Mark	Comments
1(a)	77	B1	accept [76, 78]
1(b)	10	B1	accept [9, 11]
1(c)	35 °C = 95 °F or 100 °F = 38 °C	M1	accept [93, 97] °F or [37, 39] °C
	Phoenix, with a correct comparison	A1	

Question 2 A14 · Foundation · Grade 3 · 3 marks

Q	Answer	Mark	Comments
2(a)	7	B1	
2(b)	04:00	B1	accept [03:50, 04:10]
	08:00	B1	accept [07:50, 08:10]

Question 3 A14 · Foundation · Grade 3 · 3 marks

Q	Answer	Mark	Comments
3	a straight line sloping up from O	B1	
	a horizontal line following it	B1	
	a straight line back to distance 0 that is steeper than the first line	B1	

Question 4 R14 · Common · Grade 4 · 2 marks

Q	Answer	Mark	Comments
4(a)	A	B1	
4(b)	C	B1	

Question 5 A14 · Foundation · Grade 4 · 3 marks

Q	Answer	Mark	Comments
5(a)	a straight line from (08:00, 160) to (16:00, 0)	B2	B1 for a straight line from (08:00, 160) with a negative gradient, or a straight line ending at (16:00, 0)
5(b)	12:30	B1ft	accept [12:15, 12:45], ft their straight line

Question 6 A14 · Foundation · Grade 4 · 4 marks

Q	Answer	Mark	Comments
6(a)	5	B1	
6(b)	£62 and £80	M1	both values read from the graph: accept [61, 63] for Plan A and [79, 81] for Plan B
	Plan A by £18	A1ft	ft the difference between their two readings
6(c)	the cost of each visit on Plan A	B1	oe, e.g. £4 per visit

Question 7 A14 · Foundation · Grade 5 · 2 marks

Q	Answer	Mark	Comments
7	A: Q, B: R, C: P	B2	B1 for one correct

Question 8 A14 R14 · Common · Grade 5 · 5 marks

Q	Answer	Mark	Comments
8(a)	4, 2, 1.5	B2	in the right places. B1 for two correct
8(b)	all 6 points from their table plotted correctly	B1ft	within half a square
	a smooth curve through their points	B1	
8(c)	48	B1ft	accept [45, 51], ft their curve

Question 9 A15 A14 · Higher · Grade 9 · 5 marks

Q	Answer	Mark	Comments
9	a velocity-time sketch, or the time slowing down is half the time speeding up	M1	eg T and $\frac{T}{2}$
	the time at 4 m/s is $40 - 1.5T$	M1	oe
	$\frac{1}{2} \times T \times 4 + 4(40 - 1.5T) + \frac{1}{2} \times \frac{T}{2} \times 4 = 130$	M1	oe, the area equal to 130
	$T = 10$	A1	from $160 - 3T = 130$
	0.4	A1	oe, $\frac{2}{5}$

Question 10 A14 · Foundation · Grade 2 · 3 marks

Q	Answer	Mark	Comments
10(a)	13.6	B1	accept [13, 14.2]
10(b)	their reading for 7 gallons $\times 1.43$	M1	reading in [31, 32.6], or 31.8 seen
	£45.51	A1	accept [£44.33, £46.62]

Question 11 A14 · Foundation · Grade 3 · 5 marks

Q	Answer	Mark	Comments
11(a)	27	B1	accept [26.5, 27.5]
11(b)	$(27 - 8) \div 4$ or $(36.5 - 8) \div 6$	M1	oe, two readings from the graph, ft their (a)
	£4.75	A1	accept [4.70, 4.80]
11(c)	$(50 - 8) \div 4.75$ or 8.84...	M1	oe, ft their (b), or $8 + 4.75 \times 8 = 46$ and $8 + 4.75 \times 9 = 50.75$
	8	A1	not 9

Question 12 A14 · Foundation · Grade 4 · 4 marks

Q	Answer	Mark	Comments
12(a)	15	B1	
12(b)	$12 \div 0.5$ or 12×2 or $12 \div 30 \times 60$	M1	oe
	24	A1	
12(c)	on her way home, as the line is steeper	B1	oe, or with speeds 24 km/h and 30 km/h

Question 13 A15 A14 R14 · Higher · Grade 6 · 5 marks

Q	Answer	Mark	Comments
13(a)	$\frac{12}{20}$	M1	oe
	0.6	A1	
13(b)	one correct area: $\frac{1}{2} \times 20 \times 12$ or 120 , 40×12 or 480 , $\frac{1}{2} \times 30 \times 12$ or 180	M1	oe
	a complete method for the total area	M1	oe, e.g. $\frac{1}{2} \times (40 + 90) \times 12$
	780	A1	

Question 14 A15 R15 A14 · Higher · Grade 7 · 5 marks

Q	Answer	Mark	Comments
14(a)	$\frac{90 - \text{their reading at 20}}{20}$	M1	reading at 20 minutes in [44, 48]
	2.2	A1	accept [2.1, 2.3]
14(b)	a tangent drawn at $t = 10$	M1	
	$\frac{\text{change in temperature}}{\text{change in time}}$ for their tangent	M1	using two points on the tangent
	2.1	A1	accept [1.7, 2.6]

Question 15 A15 · Higher · Grade 8 · 4 marks

Q	Answer	Mark	Comments
15(a)	readings 6.4, 9.6, 9.6 and 6.4 at 2, 4, 6 and 8 seconds	M1	each reading ± 0.2
	$\frac{1}{2} \times 2 \times (0 + 6.4) + \frac{1}{2} \times 2 \times (6.4 + 9.6) + \frac{1}{2} \times 2 \times (9.6 + 9.6) + \frac{1}{2} \times 2 \times (9.6 + 6.4)$	M1	oe, four trapezia (or a triangle and three trapezia)
	57.6	A1	accept [56, 59]
15(b)	underestimate, as the trapezia are all below the curve	B1	oe, e.g. the tops of the strips are under the curve

Question 16 A15 A14 · Higher · Grade 8 · 6 marks

Q	Answer	Mark	Comments
16(a)	the volume of water (in litres) that flows into the tank	B1	oe
16(b)	readings 28, 40 and 36 at 20, 40 and 60 minutes	M1	each ± 1
	$\frac{1}{2} \times 20 \times (0 + 28) + \frac{1}{2} \times 20 \times (28 + 40) + \frac{1}{2} \times 20 \times (40 + 36)$	M1	oe, a triangle and two trapezia
	1720	A1	accept [1690, 1750]
16(c)	$250 + 1720 = 1970$, which is less than 2000	B1ft	oe, ft their (b)
	No, as the strips are under the curve so the estimate is too small, and the real volume could be more than 1750 litres	B1	oe, Lena cannot be sure

Question 17 A15 A14 · Higher · Grade 8 · 5 marks

Q	Answer	Mark	Comments
17(a)	a tangent drawn at $t = 4$	M1	
	$\frac{\text{change in height}}{\text{change in time}}$ for their tangent	M1	using two points on the tangent
	22	A1	accept [18, 27]
17(b)	6.5	B1	accept [5.5, 7.5], where the curve is steepest
17(c)	the average rate of growth (in cm per week) between 2 weeks and 10 weeks	B1	oe, must mean average

Question 18 A15 R11 · Higher · Grade 8 · 5 marks

Q	Answer	Mark	Comments
18(a)	81 km/h = 22.5 m/s	M1	oe, or the times in hours
	$\frac{1}{2} \times 48 \times 22.5 + 135 \times 22.5 + \frac{1}{2} \times 36 \times 22.5$	M1	oe, the area under a velocity-time graph, 3982.5 m
	3.9825	A1	accept 3.98
18(b)	$48 + \left(\frac{3982.5}{2} - 540 \right) \div 22.5$	M1	oe, $48 + 1451.25 \div 22.5$, ft their distance
	112.5	A1	from $48 + 64.5$

Question 19 A12 R16 · Higher · Grade 8 · 5 marks

Q	Answer	Mark	Comments
19(a)	$a = 500$	B1	
	$b^3 = \frac{864}{500}$	M1	oe, or $b^3 = 1.728$
	$b = 1.2$	A1	
19(b)	500×1.2^t worked out for a whole number $t \geq 7$	M1	eg 1791.6... for $t = 7$, ft their a and b
	8, with 1791.6... and 2149.9...	A1	both values seen

Question 20 A15 A12 · Higher · Grade 9 · 6 marks

Q	Answer	Mark	Comments
20(a)	$\frac{3 \times 1.3^8 - 3}{8}$	M1	oe, 2.684... thousand
	2680	A1	
20(b)	a straight line from (0, 3) to (8, 24.5) drawn	M1	or any line with gradient 2.68
	a tangent to the curve parallel to that line	M1	
	4.7	A1	accept [4.2, 5.1]
20(c)	the curve gets steeper all the time, so each gradient happens only once	B1	oe, the rate of increase keeps going up

Question 21 A15 A14 · Higher · Grade 9 · 6 marks

Q	Answer	Mark	Comments
21(a)	readings 5.1, 8.3, 10.4, 11.7 at 3, 6, 9 and 12 seconds	M1	each ± 0.2
	$\frac{1}{2} \times 3 \times (0 + 5.1) + \frac{1}{2} \times 3 \times (5.1 + 8.3) + \frac{1}{2} \times 3 \times (8.3 + 10.4) + \frac{1}{2} \times 3 \times (10.4 + 11.7)$	M1	oe
	89	A1	accept [87, 91]
21(b)	7	B1ft	8×12 – their (a), from $96 - 89$
21(c)	5.6	B1	accept [5.3, 6.0], where the car's speed is 8 m/s
	before this time the cyclist is faster, so the gap grows; after it the car is faster, so the gap shrinks	B1	oe