Y11 MATHEMATICAL STUDIES – SAW REVIEW 2012 solutions

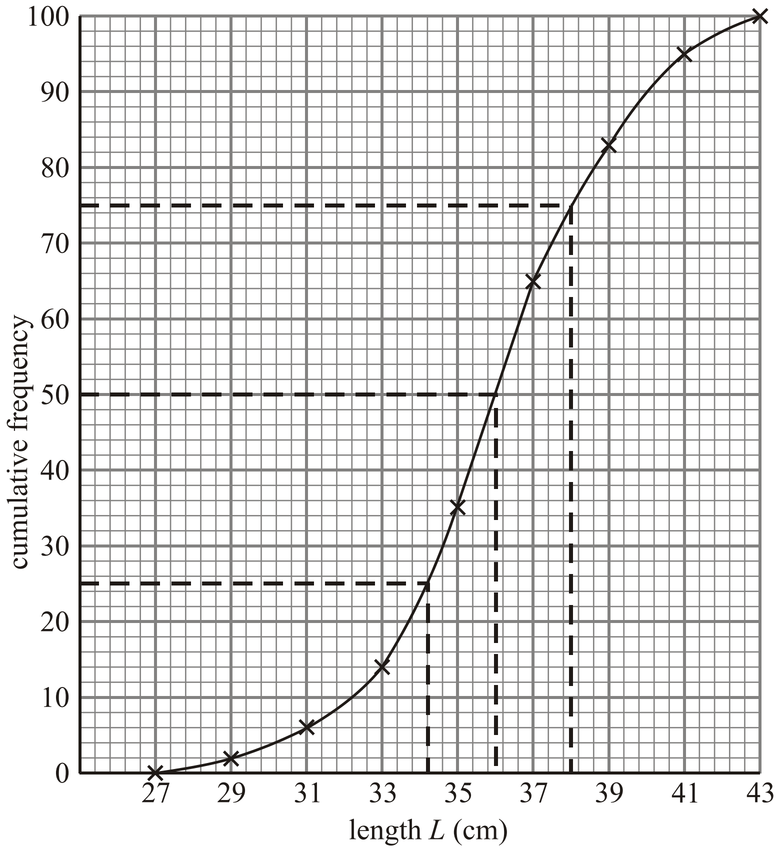
1. (a)

L (cm)	f	Σf
≤ 29	2	2
≤ 31	4	6
≤ 33	8	14
≤ 35	21	35
≤ 37	30	65
≤ 39	18	83
≤ 41	12	95
≤ 43	5	100

(A2) 2

Notes: *Award (Al) for four correct entries in the column headed Σf.*
Award (A2) for all 8 correct.

(b)



(A3) 3

Notes: *Award (Al) for both axes and correct scale.*
Award [½ mark] for each correctly plotted point and round up to a maximum of [2 marks].

(c) (i) Median length of mackerel = 36 cm ± 0.2 cm (M1)
= 36 cm (A1)

(ii) Interquartile range of mackerel length = 3.8 ± 0.2 cm (M1)
= 4 cm (A1) 4*

**(read from candidate's curve)*

[9]

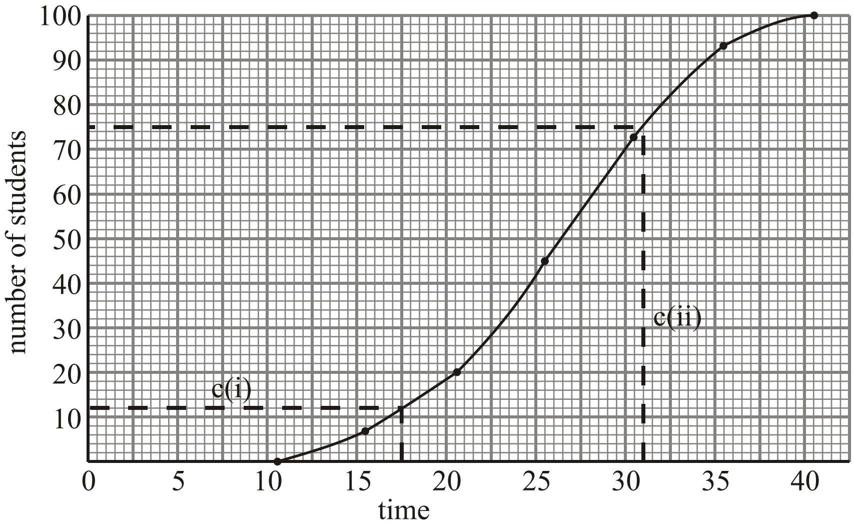
2. (a)

Time less than (mins)	Cumulative frequency
10.5	0
15.5	7
20.5	20
25.5	45
30.5	73
35.5	93
40.5	100

(A2) 2

Note: *Award (A1) for each correct column*

(b)



(A3) 3

Note: *Award (A1) for the correct scale and labelling.*
Award (A2) for plotting 6 or 7 points correctly, (A1) for plotting 4 or 5 points correctly.

(c) (i) 12 ± 1 students (allow **ft**) (A1)

(ii) 31 ± 0.5 minutes (allow **ft**) (A1) 2

[7]

3. (a) Mean = $\frac{60}{10}$

= 6 (A1) (C1)

(b) Mode = 2 (A1) (C1)

(c) 2, 2, 2, 4, 5, 6, 8, 9, 10, 12

↑

Median = $\frac{5+6}{2}$ (M1)

= 5.5 (A1) (C2)

[4]

4. (a) 19 or 20 people (A1)

(b) Median salary = 15000 GBP (A1)

(c) 80% of 200

= 160

23000 ± 500 (M1)

(A1)

[4]

5. (a) 63 kg (A1) 1

(b) (i) 70.5 kg (G1)

(ii) 14.6 kg (also accept 15.2 kg) (G1) 2

(c) Total weight of 12 students = 846 kg

Total weight of 11 students = 11 × 70 = 770 kg (M1)

Weight of student who left = 846 – 770 = 76 kg (A1) 2

[5]

6. (a) Median = 45 (A1)

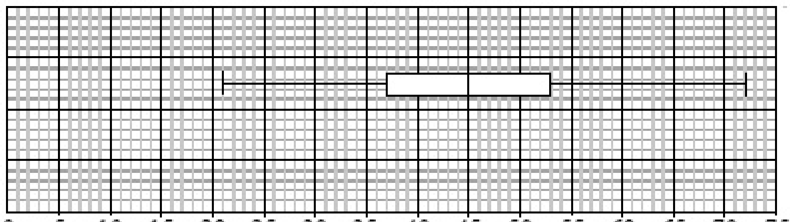
Note: *Accept 45.5* (C1)

(b) 53 – 37 *for identifying correct quartiles* (A1)

= 16 *for correct answer to subtraction* (A1)(ft)

Note: *(ft) on their quartiles* (C2)

(c)



Median marked correctly.	(A1)(ft)		
Box with ends at candidate's quartiles.	(A1)(ft)		
End points at 21 and 72 joined to box with straight lines.	(A1)		
Note: *Award (A0) if lines go right through the box.*		(C3)	
			[6]

7. (a) At B, the gradient is zero.
From B to C, the gradient is negative.
At C, the gradient is zero.
From C to D, the gradient is positive.
At D, the gradient is zero. (A3) 3

Note: *Award [½ mark] for each correct statement and round up.*

(b) Gradient = $\frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{f(a+4) - f(a)}{(a+4) - (a)}$ (M2)

Note: *Award (M1) for f(a + 4)*

$= \frac{f(a+4) - f(a)}{4}$ (A1) 3

[6]

8. (a) $2x + y$ (A1) 1

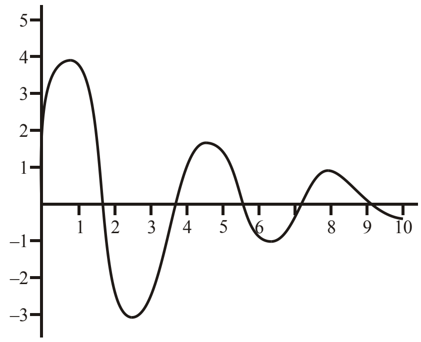
(b) $2500 = 2x + y$ (M1)
$2500 - 2x = y$ (AG) 1

(c) (i) Area $A(x) = xy$ (M1)
$= x(2500 - 2x)$ (M1)
$= 2500x - 2x^2$ (AG) 2

(ii)	$A'(x) = 2500 - 4x$	(A1)	1
(iii)	$A'(x) = 0$		
	$0 = 2500 - 4x$	(M1)	
	$4x = 2500$	(M1)	
	$x = 625$	(A1)	3
(iv)	$A(x) = 2500x - 2x^2$		
	$A(625) = 2500 \times 625 - 2(625)^2$	(M2)	
	$= 781250$		
	$= 781000 \text{ m}^2$	(A1)	3

[11]

9. (a)



For labels and scales.	(A1)	
3 maxima drawn.	(A1)	
2 minima drawn.	(A1)	
General shape	(A2)	5

(b) (0.827, 4.12) (G2) 2

(c) 0, 1.8, 3.6, 5.4, 7.2, 9 (for any one of these answers). (G1) 1

(d) $r = 1$ (G2)
Perfect positive correlation. (R1) 3

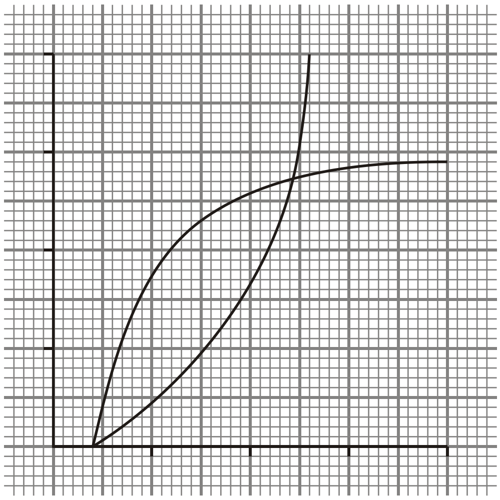
(e) $y = 3x$ (accept $y = 3x + 0.000274$) (G2) 2

(f) line on graph (A1) 1

(g) (0, 0) or (1.16, 3.48) (G1) (G1) 2

[16]

10. (a)



		For correct axes from 0 to 4.	(A1)	
		For correct curve $y = x^2$.	(A1)	
		For correct curve $y = 3 - \frac{1}{x}$.	(A1)	
		For two intersections.	(A1)	4
(b)		(0.347, 0.121) or $x = 0.347$, $y = 0.121$ (by GDC)	(G1)(G1)	
		(1.53, 2.35) or $x = 1.53$, $y = 2.35$.	(G1)(G1)	4
(c)	(i)	$\frac{dy}{dx} = \frac{1}{x^2}$ for losing the constant.	(A1)	
		For attempting to write $\frac{1}{x}$ as a power (can be implied).	(M1)	
		For correct answer $\frac{1}{x^2}$ or x^{-2}.	(A1)	
	(ii)	1	(A1)	4
(d)		For using $y = mx + c$ or equivalent with their m, to find c.	(M1)	
		$c = 1$	(A1)	
		$y = x + 1$	(A1)	3

[15]

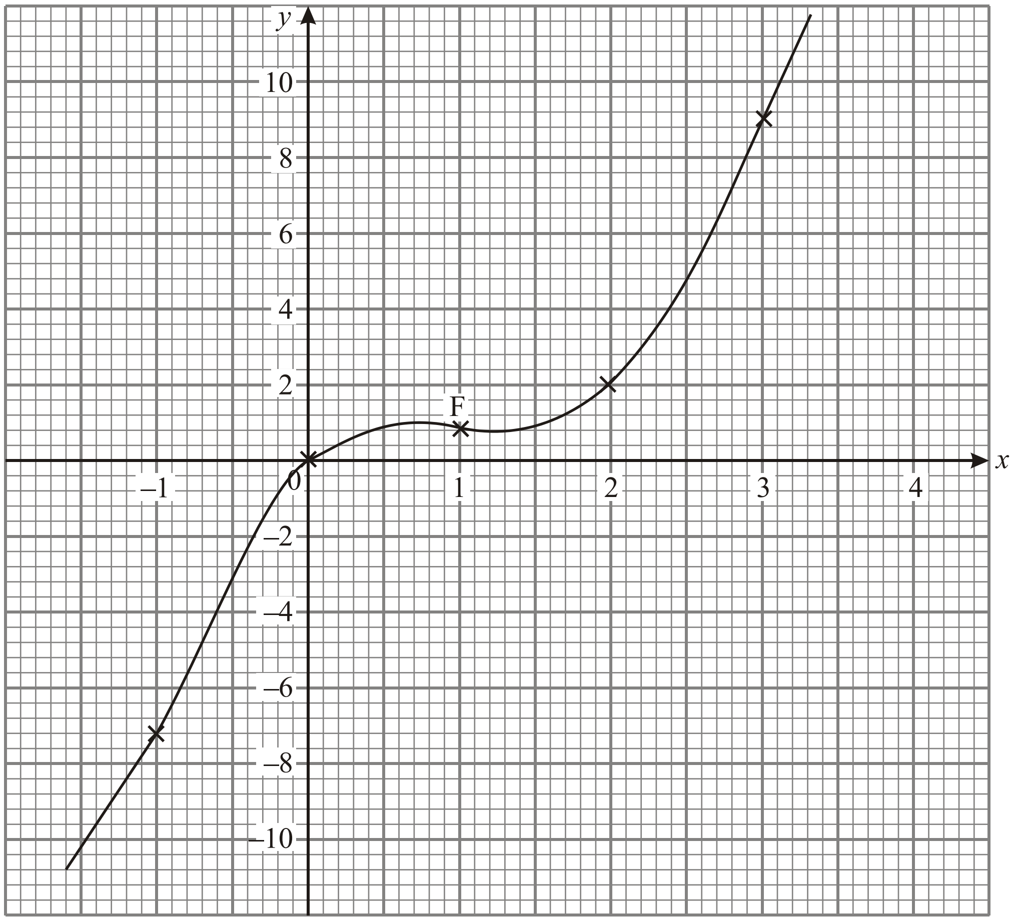
11. (a) $f'(x) = 3x^2 - 6x + 3$ (A2) 2

(b)

x	-1	0	1	2	3
$f(x)$	-7	0	1	2	9
$f'(x)$	12	**3**	0	**3**	12

(A3) 3

(c)



Note: *The graph does not have to be on graph paper as long as it is reasonable.* (A2) 2

(d) 12 (A1) 1

[8]

12. (a) $3x^{-2}$ (A1) (C1)

Note: *Award mark for –2.*

(b) $-2 \times 3x^{-3}$ (A1)(A1)

Note: *Award (A1) for -2×3, (A1) for -3.*

$= -6x^{-3}$ (A1)

$= -\dfrac{6}{x^3}$ (A1)(A1) (C5)

Note: *Award (A1) for positive power on denominator, (A1) for 3.*

[6]

13. (a) $f'(x) = 3x^2 + 14x - 5$ (A1)(A1)(A1) 3

(b) $f'(1) = 3 + 14 - 5 = 12$ (M1)(A1) 2

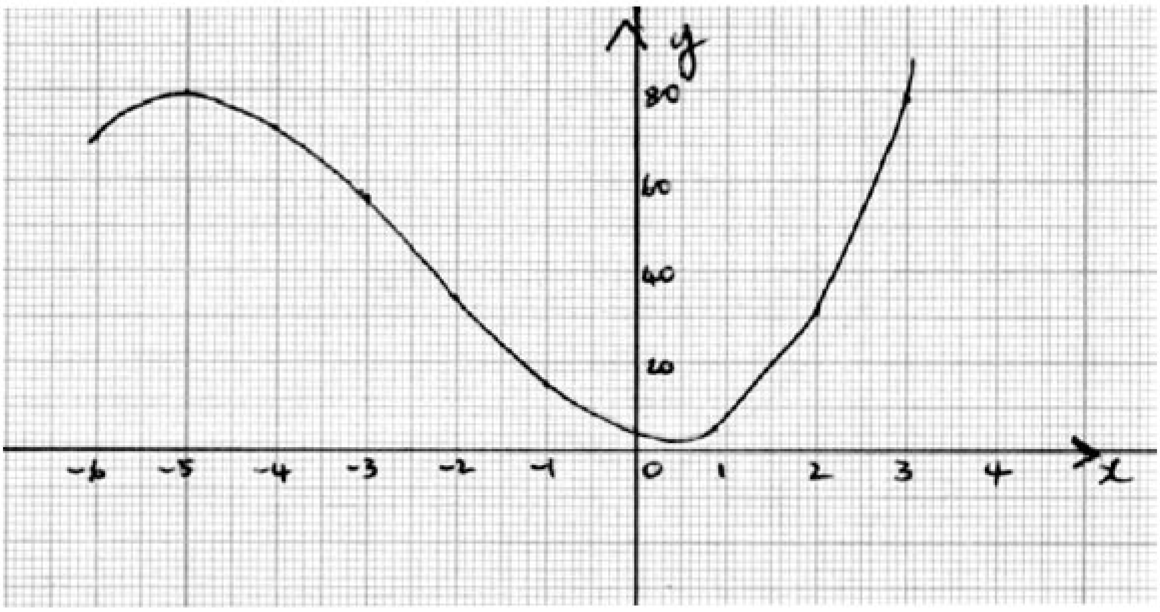
(c) $3x^2 + 14x - 5 = 0$ (M1)

$(3x - 1)(x + 5) = 0$

$x = \dfrac{1}{3}\ or - 5$ (A1)(A1) (or (G3)) 3

(d) $\left(\dfrac{1}{3}, 3.15\right)$ $(-5, 79)$ (A1)(A1) (or (G2)) 2

(e) (A4) 4



Note: *Award (A1) for axes labelled, (A1) for maximum, (A1) for minimum, (A1) for y-intercept.*

[14]

14. (a) (i) $v(1) = 1^3 - 4(1)^2 + 4(1)$

$= 1 \text{ ms}^{-1}$ (A1)

(ii) $v(0.5) = (0.5)^3 - 4(0.5)^2 + 4(0.5)$

$= 1.125 \text{ ms}^{-1}$ accept 1.13 (3 s.f.) (A1) 2

(b) $a = v(1.5) = 1.5^3 - 4(1.5) + 4(1.5)$

$= 0.375$ (A1)

$b = v(3) = 3^3 - 4(3^2) + 4(3)$

$= 3$ (A1) 2

Table (not required)

t	0	0.5	1	1.5	2	2.5	3	3.5	4
v	0	1.125	1	0.375	0	0.625	3	7.875	16

(c) (i) $\frac{dv}{dt} = 3t^2 - 8t + 4$ (A1)

$3t^2 - 8t + 4 = 0$ (M1)

$(3t - 2)(t - 2) = 0$ (M1)

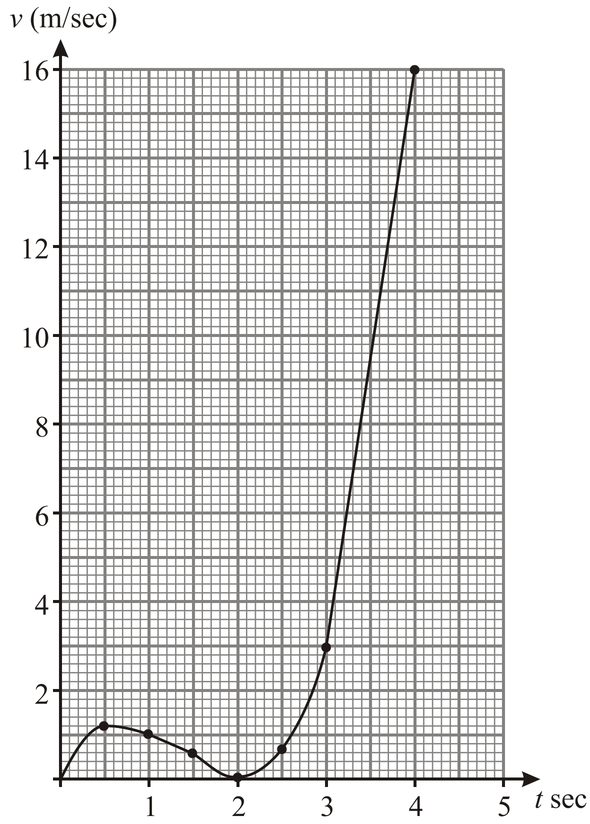
$t = \frac{2}{3}, t = 2$ (A1)(A1)

(ii) The function is changing from acceleration to deceleration *or* velocity changes from increasing to decreasing *or* kite is stationary *or* velocity is zero (R1)(R1)

Note: *Award (R1) for acceleration, (R1) for deceleration.*

Gradient = 0 (A1) 8

(d)



(A5) 5

Note: *Award (A1) for axes correctly labelled, (A1) if scales correct, (A1) for correct general shape of curve, (A1) for each turning point in approximately the correct place.*

(e)

time t	motion		
$t = 0$	stopped		
$0 < t < \frac{2}{3}$	accelerating (increasing in velocity)	(A1)	
$t = \frac{2}{3}$	stopped accelerating		
$\frac{2}{3} < t < 2$	decelerating (decreasing in velocity)	(A1)	
$t = 2$	stopped decelerating	(A1)	3
$2 < t \leq 4$	accelerating		

Note: *Stops may be left out*

[20]

15. (a) (i) $f'(x) = 6x^2 - 6x - 12\ (+0) = 6x^2 - 6x - 12$ (A2)

Note*: Award (A2) for all four items correctly differentiated, (A1) for 3 correct derivatives.*

(ii) $f'(3) = 6(3)^2 - 6(3) - 12 = 24$ (M1) (A1) 4

(b) $6x^2 - 6x - 12 = -12$ (M1)

$\Rightarrow 6x^2 - 6x = 0$

$\Rightarrow 6x\ (x - 1) = 0$

$\Rightarrow x = 0$ or $x = 1$ (A1) (A1) 3

(c) (i) $f'(x) = 0 \Rightarrow 6x^2 - 6x - 12 = 0$ (M1)

$\Rightarrow 6\ (x^2 - x - 2) = 0$

$\Rightarrow 6(x - 2)\ (x + 1) = 0$ (M1)

$\Rightarrow x = 2$ or $x = -1$ (A1) (A1)

(ii) $x = 2, y = -15$ (A1)

Therefore, minimum is $(2, -15)$ (A1) 6

(d) $x < -1$ and $x > 2$ (A1) (A1) 2

[15]