Education Bureau
Territory-wide System Assessment 2017
Secondary 3 Mathematics
Marking Scheme

Note (for Section B and C of each sub-paper):

*Mark for Answer:
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r.t. *xxx* means "accept answers which can be rounded to *xxx*".

Steps that may be skipped are shown in shade.

Alternative suggested answers are shown in boxes.

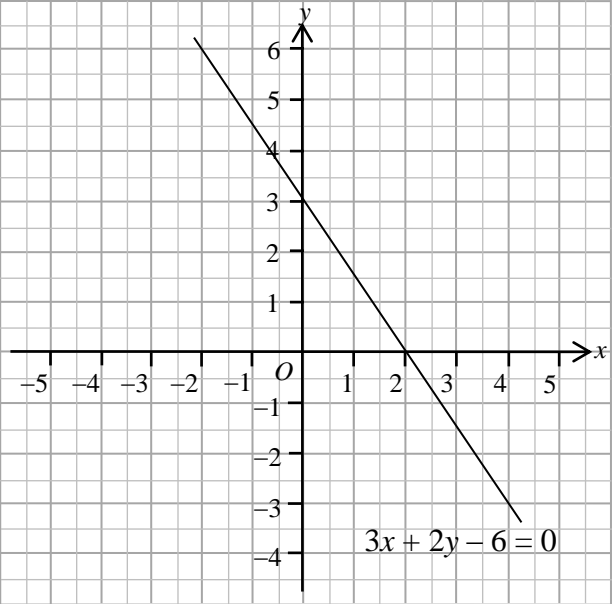Section A – Sub-paper 1 (9ME1) (1 mark each)

1. C (9ME2-1)
2. A (9ME4-1)
3. C
4. B
5. B
6. C
7. D (9ME4-7)
8. D
9. A
10. D (9ME2-10)
11. C (9ME2-13)
12. A
13. B (9ME2-11)
14. D (9ME3-14)
15. B (9ME2-15)
16. C (9ME4-16)
17. B (9ME4-17)
18. A
19. A (9ME2-20)
20. D

Section B – Sub-paper 1 (9ME1)

Question Number	Suggested Answers	Marks	Notes
21. (9ME2-21)	(i) $+3$ ⁄ 3 (ii) -2	1	Must be all correct
22.	___9.1×10^5___ bytes per second	1	
23.	There are ___48___ girl guides.	1	
24. (9ME4-24)	$x =$ ___34___ $y =$ ___55___	1	Must be all correct
25. (9ME2-25)	The coefficient of y is ___-8___ .	1	
26.	$y^3 + y^2 + 2y$	1	
27.	$(2x+1)(x-1)$	1	
28. (9ME4-28)	approximate solution	1	
29. (9ME2-28)	$a^2 + 16a + 64$	1	
30.	$x \leq -6$	1	
31.	The total surface area of the cuboid is ___222___ cm^2.	1	
32.	The order of rotational symmetry is ___5___ .	1	
33.	$x =$ ___$145°$___	1	No need to consider unit
34.	*AGHD*	1	Or its correct permutation
35. (9ME2-35)	*B*, *C*	1	Must be all correct
36.	The coordinates of point *A* are (___6___ , ___-8___) .	1	Must be all correct
37.	(i) Discrete data (ii) Continuous data	1	Must be all correct
38.	(a) <table><tr><td>**Time (min)**</td><td>1 – 10</td><td>11 – 20</td><td>21 – 30</td><td>31 – 40</td><td>41 – 50</td><td>51 – 60</td></tr><tr><td>**Frequency**</td><td>6</td><td>10</td><td>14</td><td>8</td><td>7</td><td>5</td></tr></table> (b) There are ___30___ students whose reading time is less than 30.5 minutes. (c) ___12___ students can get bookmarks.	1* (38a) 1* (38b) 1* (38c)	Must be all correct
39.	The required probability $= \dfrac{31}{100}$	1	or 0.31

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Section C – Sub-paper 1 (9ME1)

Question Number	Suggested Answers	Marks	Notes
40. (9ME4-40)	The amount $= 4650 \times 3\% \times 2 + 4650$ $\qquad\qquad = \$4929$	1 (40-1) 1* (40-2) 1** (40-3)	
41.	The time required $= \dfrac{180}{60}$ hours $\qquad\qquad\qquad = 3$ hours $\therefore$ Tommy takes 3 hours to arrive at city B.	1 (41-1) 1* (41-2) 1** (41-3)	
42.	The area of the sector $= \pi(6^2)\left(\dfrac{150°}{360°}\right)$ ≈ 47.1238898 $= 47.1\,\text{cm}^2$ (correct to the nearest $0.1\,\text{cm}^2$)	1 (42-1) 1* (42-2) 1** (42-3)	r.t. 47.1 cm^2
43.	The total surface area of the pyramid $= \dfrac{5 \times 8}{2} \times 4 + 5^2$ $= 105\,\text{cm}^2$	1 (43-1) 1* (43-2) 1** (43-3)	

Question Number	Suggested Answers	Marks	Notes
44. (9ME4-44)	 $3x + 2y - 6 = 0$	1* (44-1) 1 (44-2) 1* (44-3)	Must be all correct In case the data in the above table is incorrect, students can still use the ordered pairs to draw a straight line. The line must pass through $(-2, 6)$ and the range of x must include the values from -2 to 4. Correct graph (include: correct position, use ruler to draw the line, pass through the 3 correct points and extend two ends of the line) If the table is incomplete but no mistakes are found and the graph is correct, $(0, 1, 1)$ can be given.
45.	Of these 5 competitions, Tom's scores is less than 15 in 4 of the competitions. <center>OR</center>Of these 5 competitions, Tom's scores is higher than 15 in only 1 of the competitions. <center>OR</center>Tom applies the concept of median to the mean. ∴ I **disagree** with Tom's saying.	0 0 1 0 1 1	◆ Without any reasonable explanation ◆ Conclusion is incorrect ◆ Explanation is reasonable but incomplete ◆ Explanation is reasonable but no conclusion is drawn ◆ Explanation is reasonable and the conclusion is correct

The table in question 44 shows:

x	y
-2	6
0	3
4	-3

Question Number	Suggested Answers	Marks	Notes
46. (9ME2-46)	$\angle ABD = 55°$ (given) $\angle ACF = 125°$ (given) $\angle ACE + 125° = 180°$ (adj. $\angle$s on st. line) $\angle ACE = 55°$ $\therefore \angle ACE = \angle ABD$ $\therefore BD \,/\!/ \,FE$ (corr. $\angle$s equal)		Or other correct proofs
	Conditions		
	(1) Any correct proof with correct reasons	3	
	(2) Any correct proof with poor presentation, missing reasons or inappropriate reasons	2	
	(3) Incomplete proof with any one correct statement and one corresponding reason	1	
	(4) Incomplete proof	0	
47. (9ME2-47)	$\begin{cases} y = 2x + 4 & ...(1) \\ x + y = 19 & ...(2) \end{cases}$ Substitute (1) into (2) $x + 2x + 4 = 19$ $3x = 15$ $x = 5$ Substitute $x = 5$ into (1) $y = 2(5) + 4$ $y = 14$	1 (47-1) 1* (47-2) 1 (47-3) 1* (47-4)	Correct method (eliminating one of the variables) Correct value of x (or y) Correct method Both values are correct

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Steps that may be skipped are shown in shade.

Alternative suggested answers are shown in boxes.

Section A – Sub-paper 2 (9ME2) (1 mark each)

1. C (9ME1-1)
2. A (9ME3-2)
3. A (9ME4-2)
4. A (9ME4-4)
5. D
6. B
7. B
8. C
9. B (9ME3-8)
10. D (9ME1-10)
11. B (9ME1-13)
12. C (9ME3-12)
13. C (9ME1-11)
14. A
15. B (9ME1-15)
16. D
17. C
18. D
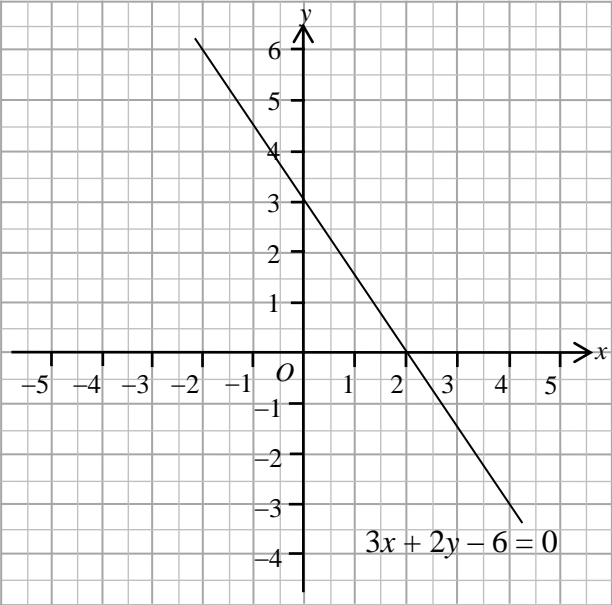19. D (9ME4-19)
20. A (9ME1-19)

Section B – Sub-paper 2 (9ME2)

Question Number	Suggested Answers	Marks	Notes
21. (9ME1-21)	(i) +3 ／ 3 (ii) –2	1	Must be all correct
22. (9ME3-22)	4.07	1	
23.	ℓ = __50__	1	
24.	$4n$	1	
25. (9ME1-25)	The coefficient of y is __– 8__ .	1	
26.	$(x+1)^2$ ／ $(x+1)(x+1)$	1	
27.	$x =$ __–6__	1	
28. (9ME1-29)	$a^2 + 16a + 64$	1	
29.	$P =$ __2__	1	
30. (9ME3-30)	$x > 3$	1	
31.	The volume of the sphere is __905__ cm^3.	1	
32.	Q and R	1	Must be all correct
33.	(a) $x = 9$ (b) $y = 100$	1	Must be all correct No need to consider unit
34.	$x = 64°$	1	No need to consider unit
35. (9ME1-35)	B, C	1	Must be all correct
36.	The coordinates of P' are (__2__ , __4__) .	1	Must be all correct
37. (9ME3-37)	$x = 12.1$	1	r.t. 12.1 No need to consider unit

Question Number	Suggested Answers	Marks	Notes
38.	**Table 1** 	Number of multiple choice questions answered correctly	Frequency
---	---
1 – 15	4
16 – 30	7
31 – 45	4	 **Table 2** 	Number of multiple choice questions answered correctly	Frequency
---	---
1 – 9	1
10 – 18	5
19 – 27	3
28 – 36	4
37 – 45	2		1* (38-1) 1* (38-2)	Must be all correct Must be all correct
39.	The weighted mean mark of Ivy is __79__ .	1	

Section C – Sub-paper 2 (9ME2)

Question Number	Suggested Answers	Marks	Notes
40.	Profit $= \$420 \times 35\%$ $= \$147$	1 (40-1) 1* (40-2) 1** (40-3)	
41.	(a) $\quad a^{-4} \cdot a^{7}$ $= a^{3}$ (b) $\quad (a^{-4} \cdot a^{7})^{2}$ $= (a^{3})^{2}$ $= a^{3 \times 2}$ $= a^{6}$	1* (41a) 1 (41b1) 1* (41b2)	 Using $(y^{m})^{n} = y^{mn}$ Correct answer (getting marks 1 1)
42. (9ME4-43)	$\because \triangle ABC$ is an equilateral triangle, $x = 60°$ $x + y = 180°$ $60° + y = 180°$ $y = 120°$	1* (42-1) 1 (42-2) 1* (42-3) 1** (42-4)	
43.	$QR^{2} = PR^{2} - PQ^{2}$ $\quad = 9.7^{2} - 6.5^{2}$ $\quad = 51.84$ $QR = 7.2$ km	1 (43-1) 1* (43-2) 1** (43-3)	

Question Number	Suggested Answers	Marks	Notes
44. (9ME3-46)	<table><tr><td>x</td><td>–2</td><td>0</td><td>4</td></tr><tr><td>y</td><td>6</td><td>3</td><td>–3</td></tr></table> $3x + 2y - 6 = 0$	1* (44-1) 1 (44-2) 1* (44-3)	Must be all correct In case the data in the above table is incorrect, students can still use the ordered pairs to draw a straight line. The line must pass through (–2, 6) and the range of x must include the values from –2 to 4. Correct graph (include: correct position, use ruler to draw the line, pass through the 3 correct points and extend two ends of the line) If the table is incomplete but no mistakes are found and the graph is correct, (0, 1, 1) can be given.
45.	(a) Units digit <table><tr><td></td><td>**3**</td><td>**6**</td><td>**8**</td></tr><tr><td>**3**</td><td>33</td><td>36</td><td>38</td></tr><tr><td>**6**</td><td>63</td><td>66</td><td>68</td></tr><tr><td>**8**</td><td>83</td><td>86</td><td>88</td></tr></table> Tens digit (b) The probability that the two-digit number formed is a multiple of $9 = \dfrac{2}{9}$	1* (45a) 1* (45b)	Must be all correct

Question Number	Suggested Answers	Marks	Notes
46. (9ME1-46)	$\angle ABD = 55°$ (given) $\angle ACF = 125°$ (given) $\angle ACE + 125° = 180°$ (adj. $\angle$s on st. line) $\angle ACE = 55°$ $\therefore \angle ACE = \angle ABD$ $\therefore BD \; // \; FE$ (corr. $\angle$s equal)		Or other correct proofs
	Conditions		
	(1) Any correct proof with correct reasons	3	
	(2) Any correct proof with poor presentation, missing reasons or inappropriate reasons	2	
	(3) Incomplete proof with any one correct statement and one corresponding reason	1	
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47. (9ME1-47)	$\begin{cases} y = 2x + 4 & ...(1) \\ x + y = 19 & ...(2) \end{cases}$ Substitute (1) into (2) $x + 2x + 4 = 19$ $3x = 15$ $x = 5$ Substitute $x = 5$ into (1) $y = 2(5) + 4$ $y = 14$	1 (47-1) 1* (47-2) 1 (47-3) 1* (47-4)	Correct method (eliminating one of the variables) Correct value of x (or y) Correct method Both values are correct

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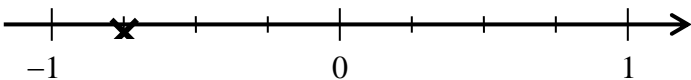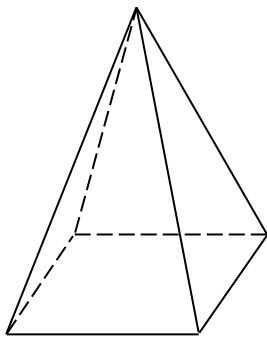
Steps that may be skipped are shown in shade.

Alternative suggested answers are shown in boxes.

Section A – Sub-paper 3 (9ME3) (1 mark each)

1. C
2. A (9ME2-2)
3. C
4. D
5. C (9ME4-5)
6. C
7. B (9ME4-6)
8. B (9ME2-9)
9. B
10. D
11. A
12. C (9ME2-12)
13. B
14. D (9ME1-14)
15. A
16. D
17. A
18. A
19. B
20. D (9ME4-20)

Section B – Sub-paper 3 (9ME3)

Question Number	Suggested Answers	Marks	Notes
21.	$A = -4$ $B = -8$ $C = 6 / +6$	1	Must be all correct
22. (9ME2-22)	4.07	1	
23. (9ME4-23)		1	
24.	The value of the 4th term of the sequence is __18__ .	1	
25.	$6a^2 + 2a$	1	
26.	$(a+4)(y+1)$	1	
27. (9ME4-27)	$(1+y)(1-y)$	1	
28.	$4x$	1	
29. (9ME4-29)	$T = 2(W-5)$ ╱ $T = 2W - 10$	1	
30. (9ME2-30)	$x > 3$	1	
31.		1	
32.	$x = 70°$ $y = 30°$	1 (32-1) 1 (32-2)	No need to consider unit
33.	$x = 80$	1	No need to consider unit
34.	AC / CA	1	
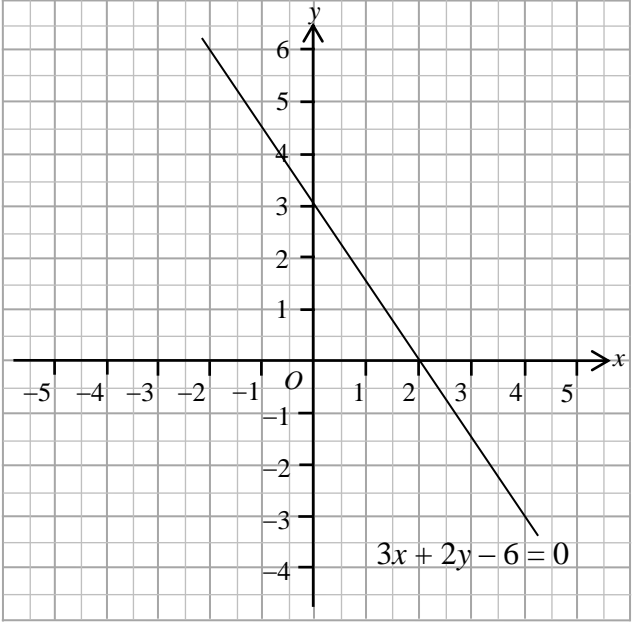
Question Number	Suggested Answers	Marks	Notes
35.	$x =$ ___5___	1	
36.	$AB =$ ___5___ units	1	
37. (9ME2-37)	$x = 12.1$	1	r.t. 12.1 No need to consider unit
38.	Mean = ___34___ mm Median = ___26___ mm	1 (38-1) 1 (38-2)	
39. (9ME4-39)	The modal class of the numbers of books borrowed is ___20___ – ___29___ .	1	Must be all correct

Section C – Sub-paper 3 (9ME3)

Question Number	Suggested Answers	Marks	Notes
40.	Compound interest $= 12560 \times (1 + 2\%)^3 - 12560$ ≈ 768.77248 $= \$769$ (correct to the nearest dollar)	1 (40-1) 1* (40-2) 1** (40-3)	r.t. \$769
41.	The value of the notebook computer this year $= 8\,400 \times (1 - 25\%)^2$ $= 4725$ ∴ The value of the notebook computer this year is \$4725. OR	1 (41-1) 1* (41-2) 1** (41-3)	
	$8400 \times 0.75 = 6300$ $6300 \times 0.75 = 4725$ The value of the notebook computer this year is \$4725 .	1 (41-1) 1* (41-2) 1** (40-3)	Correct method (multiply 0.75 twice)
42.	$x = 2\pi(10)\left(\dfrac{72°}{360°}\right)$ $= 4\pi\,\text{cm}$	1 (42-1) 1* (42-2) 1** (42-3)	
43.	$\tan \angle BAC = \dfrac{BC}{AC}$ $\tan 28° = \dfrac{BC}{20}$ $BC \approx 10.63418863$ $BC = 10.6\,\text{m}$ (correct to 3 significant figures)	1 (43-1) 1* (43-2) 1** (43-3)	r.t. 10.6 m

Question Number	Suggested Answers	Marks	Notes
44.	The height of the building is approximately 5 times the height of the lamppost. ∴ The height of the building $\approx (4 \times 5)$ m $= 20$ m	0 0 No evidence of using estimation strategies nor giving reasonable justification	◆ Answer only, without any working steps or written explanation ◆ The explanation is irrelevant or unreasonable
		1 0 Partial evidence of using estimation strategies, but the solution is incomplete or contains mistakes	◆ Using reasonable estimation strategies, but the solution is incomplete. For instance, only the height of the building is approximately 5 times the height of the lamppost is mentioned ◆ The explanation is reasonable, but the answer is outside the acceptable range ◆ The explanation is reasonable, but calculation mistakes occurred
		1 1 Estimate with reasonable justification	◆ The answer must be supported by reasonable explanation and within the acceptable range ◆ Accept the height of the building be 4.5 times to 5.5 times the height of the lamppost Acceptable range of the height of the building: 18 m to 22 m
45. (9ME4-46)	$\angle BCA = \angle ECD$ (vert. opp. ∠s) $\angle CAB = \angle CDE$ (given) $AB = DE$ (given) $\therefore \triangle ABC \cong \triangle DEC$ (AAS)		
	Conditions		
	(1) Any correct proof with correct reasons	3	
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	(3) Incomplete proof with any one correct statement and one corresponding reason	1	
	(4) Incomplete proof	0	

Question Number	Suggested Answers	Marks	Notes
46. (9ME2-44)		1* (46-1) 1 (46-2) 1* (46-3)	Must be all correct In case the data in the above table is incorrect, students can still use the ordered pairs to draw a straight line. The line must pass through (–2, 6) and the range of *x* must include the values from –2 to 4. Correct graph (include: correct position, use ruler to draw the line, pass through the 3 correct points and extend two ends of the line) If the table is incomplete but no mistakes are found and the graph is correct, (0, 1, 1) can be given.
47.	(a) see table below (b) The mean $= \dfrac{1\times6+4\times9+7\times27+10\times8}{50}$ $= 6.22$ kg	1* (47a) 1 (47b1) 1* (47b2) 1** (47b3)	Must be all correct Correct method

For Question 46:

x	–2	0	4
y	6	3	–3

$3x + 2y - 6 = 0$

For Question 47(a):

Weight (kg)	0 – 2	3 – 5	6 – 8	9 – 11
Class mark (kg)	1	4	7	10
Frequency	6	9	27	8

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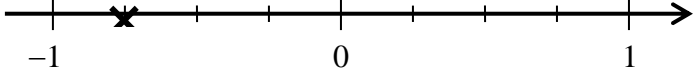Steps that may be skipped are shown in shade.

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Section A – Sub-paper 4 (9ME4) (1 mark each)

1.   A   (9ME1-2)
2.   A   (9ME2-3)
3.   C
4.   A   (9ME2-4)
5.   C   (9ME3-5)
6.   B   (9ME3-7)
7.   D   (9ME1-7)
8.   B
9.   D
10.   A
11.   D
12.   B
13.   C
14.   B
15.   C
16.   C   (9ME1-16)
17.   B   (9ME1-17)
18.   A
19.   D   (9ME2-19)
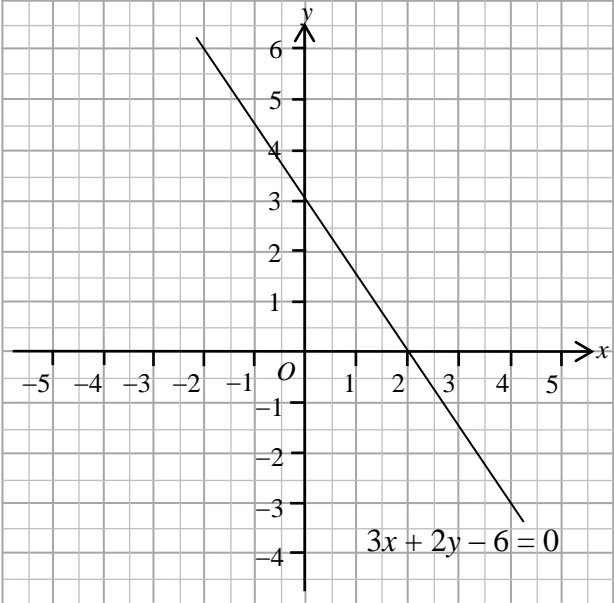20.   D   (9ME3-20)

Section B – Sub-paper 4 (9ME4)

Question Number	Suggested Answers	Marks	Notes
21.	21	1	
22.	35.486	1	
23. (9ME3-23)		1	
24. (9ME1-24)	$x = $ __34__ $y = $ __55__	1	Must be all correct
25.	$10x + 3$	1	
26.	$y^2 - 8y + 15$	1	
27. (9ME3-27)	$(1 + y)(1 - y)$	1	
28. (9ME1-28)	approximate solution	1	
29. (9ME3-29)	$T = 2(W - 5)$ ╱ $T = 2W - 10$	1	
30.	$\dfrac{2015}{2016}$ $<$ $\dfrac{2016}{2017}$	1	
31.	The circumference of the circle is __12π__ cm.	1	
32.		1	The cross-section is a rectangle
33.	(a) $x = 45$ (b) $y = 9$	1	Must be all correct No need to consider unit
34.	$\angle FAC$ ╱ $\angle CAF$	1	
35.	The polar coordinates of point A are (__3__ , __90°__).	1	Must be all correct and in order
36.	23°	1	r.t. 23° No need to consider unit

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Question Number	Suggested Answers	Marks	Notes
37.	(2) → (3) → (1) → (4)	1	
38.	(a) There are___15___part-time staff at the restaurant.	1* (38a)	
	(b) The median of the hourly wages of the part-time staff is $___43___ .	1* (38b)	
	(c) Among these 4 part-time cooks, the lowest hourly wage is $___58___ .	1* (38c)	
39. (9ME3-39)	The modal class of the numbers of books borrowed is ___20___ − ___29___ .	1	

Section C – Sub-paper 4 (9ME4)

Question Number	Suggested Answers	Marks	Notes
40. (9ME1-40)	The amount = $4650 \times 3\% \times 2 + 4650$ $\quad\quad\quad\quad = \$4929$	1 (40-1) 1* (40-2) 1** (40-3)	
41.	The height of the prism $= \dfrac{240}{30}$ $= 8$ cm	1 (41-1) 1* (41-2) 1** (41-3)	
42.	The area of the polygon $ABCDEF$ $= (8-2) \times (7-2) - (8-7) \times (4-2)$ $= 28$ sq. units	1 (42-1) 1* (42-2) 1** (42-3)	Or other correct methods
43. (9ME2-42)	$\because \triangle ABC$ is an equilateral triangle, $x = 60°$ $x + y = 180°$ $60° + y = 180°$ $y = 120°$	1* (43-1) 1 (43-2) 1* (43-3) 1** (43-4)	

Question Number	Suggested Answers	Marks	Notes
44. (9ME1-44)	<table><tr><td>x</td><td>y</td></tr><tr><td>−2</td><td>6</td></tr><tr><td>0</td><td>3</td></tr><tr><td>4</td><td>−3</td></tr></table> $3x + 2y - 6 = 0$	1* (44-1) 1 (44-2) 1* (44-3)	Must be all correct In case the data in the above table is incorrect, students can still use the ordered pairs to draw a straight line. The line must pass through (−2, 6) and the range of x must include the values from −2 to 4. Correct graph (include: correct position, use ruler to draw the line, pass through the 3 correct points and extend two ends of the line) If the table is incomplete but no mistakes are found and the graph is correct, (0, 1, 1) can be given.

Question Number	Suggested Answers	Marks	Notes
45.	The number of seats provided by the theatre $= 22 \times 41$ $\geq 20 \times 40$ $= 800$ $\therefore$ The theatre has enough seats for 800 people.	0 0 No evidence of using estimation strategies nor giving reasonable justification	◆ Exact calculation only ◆ The estimate is given only after exact calculation ◆ Use wrong methods to get the approximations for the underlined values
		1 0 Partial evidence of using estimation strategies, but the solution is incomplete or contains errors	◆ Approximate the underlined values correctly, but the number of seats provided by the theatre is omitted or wrongly estimated ◆ Estimate the number of seats provided by the theatre correctly, but the conclusion is omitted or wrong ◆ Correct method used, but errors occurred
		1 1 Estimate with reasonable justification	◆ No need to consider unit/presentation ◆ The conclusion must be correct and aligned with a reasonable explanation
46. (9ME3-45)	$\angle BCA = \angle ECD$ (vert. opp. $\angle$s) $\angle CAB = \angle CDE$ (given) $AB = DE$ (given) $\therefore \triangle ABC \cong \triangle DEC$ (AAS)		

Conditions：	
(1) Any correct proof with correct reasons	3
(2) Any correct proof with poor presentation, missing reasons or inappropriate reasons	2
(3) Incomplete proof with any one correct statement and one corresponding reason	1
(4) Incomplete proof	0

Question Number	Suggested Answers	Marks	Notes
47.	(a) <table><tr><th>Capacities (mL)</th><th>Class boundaries (mL)</th><th>Class mark (mL)</th><th>Frequency</th></tr><tr><td>200 – 290</td><td>195 – 295</td><td>245</td><td>3</td></tr><tr><td>300 – 390</td><td>295 – 395</td><td>345</td><td>6</td></tr><tr><td>400 – 490</td><td>395 – 495</td><td>445</td><td>7</td></tr><tr><td>500 – 590</td><td>495 – 595</td><td>545</td><td>4</td></tr></table> (b) **Capacities of 20 bottles** 	1* (47a1) 1* (47a2) 1* (47b)	Correct histogram (No marks will be given if any charts other than histogram are shown)