Education Bureau
Territory-wide System Assessment 2023
Secondary 3 Mathematics
Marking Scheme

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

*Mark for Answer:

(1) The Mark for Answer may be given when there is a correct answer without any work shown.

(2) If the work shown is incorrect, the Mark for Answer will not be given.

(3) If the work shown is poorly presented but there is a correct answer, the Mark for Answer may be given.

**Mark for Presentation:

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(3) If the numerical value of the answer is correct but not the approximate value as required by the question, the Mark for Presentation will not be given.

(4) The Mark for Presentation may include overall work such as mathematical expressions, units, written explanations, use of symbols, etc.
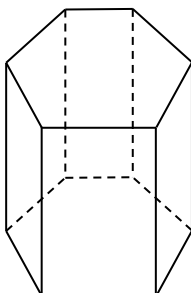
r.t. *xxx* means "accept answers which can be rounded to *xxx*".

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)

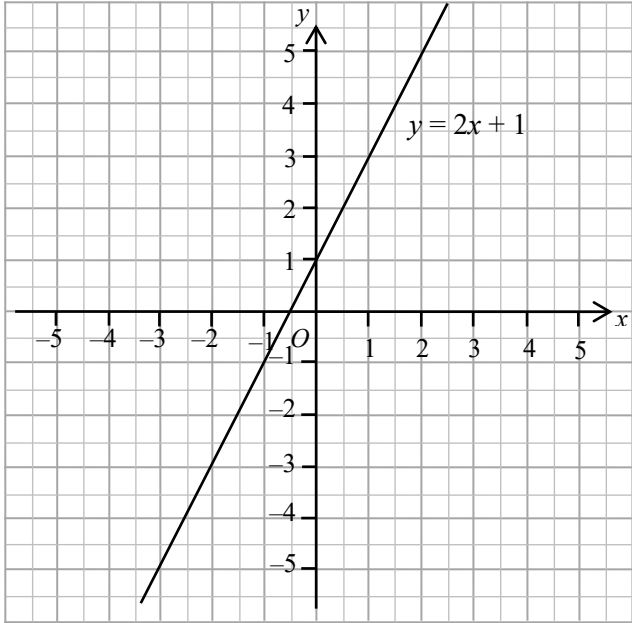|		
1.	A	(9ME4-1)
2.	D	
3.	B	(9ME4-2)
4.	D	
5.	D	(9ME4-3)
6.	B	(9ME2-4)
7.	B	(9ME4-5)
8.	D	(9ME2-7)
9.	C	(9ME4-8)
10.	C	(9ME4-9)
11.	C	
12.	A	(9ME2-12)
13.	C	(9ME2-13)
14.	A	(9ME2-14)
15.	D	
16.	C	
17.	A	(9ME2-16)
18.	A	
19.	B	(9ME2-19)
20.	B	(9ME4-19)

Section B – Sub-paper 1 (9ME1)

Question Number	Suggested Answers	Marks	Notes
21.	$3^2 \times 5$	1	
22.	(i) __+1 / 1__ hour(s) represents that the local time in Seoul is 1 hour ahead of the local time in Hong Kong. (ii) __−12__ hour(s) represents that the local time in New York is 12 hours behind the local time in Hong Kong.	1 1	Must be all correct
23.	$a =$ __512__	1	
24. (9ME2-26)	$x =$ __3__	1	
25.	(i) Direct proportion (ii) Inverse proportion	1	Must be all correct
26. (9ME4-29)	$(x + 6)^2$	1	
27. (9ME4-27)	$x^2 + 4x − 5$	1	
28.	$(x − 1)(x − 6)$	1	
29. (9ME4-30)	$\dfrac{5}{2x}$	1	
30. (9ME4-31)	$x < − 7$	1	
31.		1	
32.	$x =$ __65°__	1	No need to consider unit
33.	$x =$ __55°__	1	No need to consider unit
34.	(a) $x =$ __17__ (b) $y =$ __48__	1	Must be all correct No need to consider unit
35.	Q and R	1	Must be all correct
36.	$x =$ __34.7__	1	r.t. 34.7 No need to consider unit

Question Number	Suggested Answers	Marks	Notes
37. (9ME2-37)	(a) <table><tr><td>Time (minutes)</td><td>31 – 40</td><td>41 – 50</td><td>51 – 60</td><td>61 – 70</td><td>71 – 80</td><td>81 – 90</td></tr><tr><td>Frequency</td><td>4</td><td>8</td><td>17</td><td>24</td><td>21</td><td>26</td></tr></table> (b) The total number of Secondary 3 students in the school is __100__ . (c) The number of Secondary 3 students joining the activity is __71__ .	1 (37a) 1 (37b) 1 (37c)	No need to consider unit
38. (9ME2-39)	Mean = __10__ Median = __12__	1 (38-1) 1 (38-2)	
39.	The required relative frequency = $\dfrac{3}{5}$	1	Or 0.6

Section C – Sub-paper 1 (9ME1)

Question Number	Suggested Answers	Marks	Notes
40.	Interest = \$5 720 × 3% × 5 = \$858	1 (40-1) 1* (40-2) 1** (40-3)	
41.	The number of infected people = $2\,000 \times (1-30\%)^3$ = 686 or 2 000 × 0.7 = 1 400 1 400 × 0.7 = 980 980 × 0.7 = 686 The number of inflected people is 686.	1 (41-1) 1* (41-2) 1** (41-3) 1 (41-1) 1* (41-2) 1** (41-3)	Correct method (multiply 0.7 three times)
42. (9ME4-41)	<table><tr><td>x</td><td>−3</td><td>0</td><td>2</td></tr><tr><td>y</td><td>−5</td><td>1</td><td>5</td></tr></table> 	1* (42-1) 1 (42-2) 1* (42-3)	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 (0, 1) and the range of x must include the values from −3 to 2. 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
43.	(a) $x^{-4} \cdot x^6$ $= x^{-4+6}$ $= x^2$ (b) $(x^{-4} \cdot x^6)^5$ $= (x^2)^5$ $= x^{2 \times 5}$ $= x^{10}$	1* (43a) 1 (43b1) 1* (43b2)	 using $(a^m)^n = a^{mn}$ Correct answer (getting marks 1　1*)
44.	$\angle CDF + 86° + 64° = 180°$　(∠ sum of △) $\angle CDF = 30°$ ∵ $\angle ABD = \angle CDF = 30°$ ∴ $AB \ // \ CD$　　　(corr. ∠ 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	
45. (9ME4-44)	$AB = \sqrt{2.4^2 + 7^2}$ $= 7.4$ cm The perimeter of the rhombus $= 4 \times 7.4$ $= 29.6$ cm	1 (45-1) 1* (45-2) 1** (45-3)	
46. (9ME4-45)	The area of $\triangle ABC$ $= \dfrac{[2-(-4)] \times (6-1)}{2}$ $= 15$ sq. units	1 (46-1) 1* (46-2) 1** (46-3)	Or other correct methods

Question Number	Suggested Answers	Marks		Notes
47.	The number of half of the types of drinks is 4. There are only 2 types of drinks pricing $18 or more. Therefore, it is not true that over half of the types of drinks are $18 or more.	0	0	◆ Without any reasonable explanation ◆ Conclusion is incorrect
	or The number of half of the types of drinks is 4. There are 6 types of drinks pricing less than $18. Therefore, it is not true that over half of the types of drinks are $18 or more.	1	0	◆ Explanation is reasonable but incomplete ◆ Explanation is reasonable but no conclusion is drawn
	∴ I **disagree** with the customer's claim.	1	1	◆ Explanation supported by data is reasonable and the conclusion is 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.   D
2.   C   (9ME3-2)
3.   D   (9ME3-4)
4.   B   (9ME1-6)
5.   C
6.   A   (9ME3-8)
7.   D   (9ME1-8)
8.   B
9.   D
10.   D
11.   C
12.   A   (9ME1-12)
13.   C   (9ME1-13)
14.   A   (9ME1-14)
15.   B   (9ME3-15)
16.   A   (9ME1-17)
17.   C   (9ME3-17)
18.   B
19.   B   (9ME1-19)
20.   A   (9ME3-19)

Section B – Sub-paper 2 (9ME2)

Question Number	Suggested Answers	Marks	Notes
21. (9ME3-21)	36	1	
22. (9ME3-22)	– 3	1	
23.	12	1	
24.	The electricity consumption of the company is <u>969 kWh</u> this month.	1	No need to consider unit
25.	$x =$ <u>36</u>	1	
26. (9ME1-24)	$x =$ <u>3</u>	1	
27.	The coefficient of x^2 is <u>–7</u> .	1	
28.	$(x + y)(5 - a)$ / $(5 - a)(x + y)$	1	
29. (9ME3-27)	$y^2 - 8y + 16$	1	
30.	$2x$	1	
31.	$y = 5(w - k)$ / $y = 5w - 5k$	1	
32.	Solid R	1	
33.	The volume of the prism is <u>540 cm^3</u> .	1	No need to consider unit
34.	$x =$ <u>125°</u>	1	No need to consider unit
35. (9ME3-33)	$x =$ <u>40°</u>	1	No need to consider unit
36.	The angle of elevation of Q from P is <u>42°</u> .	1	No need to consider unit

Question Number	Suggested Answers	Marks	Notes
37. (9ME1-37)	(a) <table><tr><td>Time (minutes)</td><td>31 – 40</td><td>41 – 50</td><td>51 – 60</td><td>61 – 70</td><td>71 – 80</td><td>81 – 90</td></tr><tr><td>Frequency</td><td>4</td><td>8</td><td>17</td><td>24</td><td>21</td><td>26</td></tr></table> (b) The total number of Secondary 3 students in the school is ___100___. (c) The number of Secondary 3 students joining the activity is ___71___.	1(37a) 1(37b) 1(37c)	No need to consider unit
38.	In 2021 and 2022, the average relative humidity in ___March___ is the same.	1	
39. (9ME1-38)	Mean = ___10___ Median = ___12___	1 (39-1) 1 (39-2)	

Section C – Sub-paper 2 (9ME2)

Question Number	Suggested Answers	Marks	Notes
40.	The total calorie intake = 381 + 532 + 1 706 > 300 + 500 + 1 700 = 2 500 calories ∴ Mr Chan's calorie intake today is **over** the standard.	0 0 No evidence of using estimation strategies nor giving reasonable justification	◆ Exact calculation ◆ The estimate is given only after exact calculation ◆ Use wrong methods to get the approximation for the calories of each value
		1 0 Partial evidence of using estimation strategies, but the solution is incomplete or contains errors	◆ Estimate the calorie of each value correctly, but the total calorie intake is omitted or wrongly estimated ◆ Estimate the total calorie intake 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
41.	The number of facemasks for each person $= \dfrac{4 \times 15}{6}$ = 10	1 (41-1) 1* (41-2) 1** (41-3)	

Question Number	Suggested Answers	Marks	Notes
42. (9ME3-42)	$\begin{cases} y = 3x + 8 & ...(1) \\ x + y = 4 & ...(2) \end{cases}$ Substitute (1) into (2), $x + 3x + 8 = 4$ $\quad\quad 4x = -4$ $\quad\quad\;\; x = -1$ Substitute $x = -1$ into (1), $\quad\quad y = 3(-1) + 8$ $\quad\quad y = 5$	1 (42-1) 1* (42-2) 1 (42-3) 1* (42-4)	Correct method (eliminating one of the variables) Correct value of x (or y) Correct method Both values are correct
43. (9ME3-43)	$x = 2\pi(4) \times \dfrac{95°}{360°}$ ≈ 6.632251 $= 6.63$ cm (corr. to 3 sig. fig.)	1 (43-1) 1* (43-2) 1** (43-3)	r.t. 6.63 cm
44.	The volume of Ball B $= 2\,700 \times \left(\dfrac{1}{3}\right)^3$ $= 100$ cm^3	1 (44-1) 1* (44-2) 1** (44-3)	

Question Number	Suggested Answers	Marks	Notes
45.	$\angle ACB = 180° - 50° - 65° = 65°$ ($\angle$ sum of $\triangle$) $\because \angle CAB = \angle ACB = 65°$ $\therefore BA = BC$ (sides opp. eq. $\angle$s) $\therefore \triangle BCA$ is an isosceles triangle		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	
46.	$\tan \angle ACB = \dfrac{AB}{BC}$ $\tan \angle ACB = \dfrac{5}{3}$ $\angle ACB \approx 59.03624347°$ $\angle ACB = 59.0°$ (correct to 3 sig. fig.)	1 (46-1) 1* (46-2) 1** (46-3)	 r.t. 59.0°
47.	**Number of absentees in the last 15 school days** 	Stem (10)	Leaf (1)	 	0	7 8 9	 	1	2 4 5 5 7 8	 	2	0 2 5	 	3	0 6	 	4	2		1 (47-1) 1* (47-2)	Correct data of the leave in each row (no need to consider the order) All correct (including the distances between data, the order of the data and no commas between the data）

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

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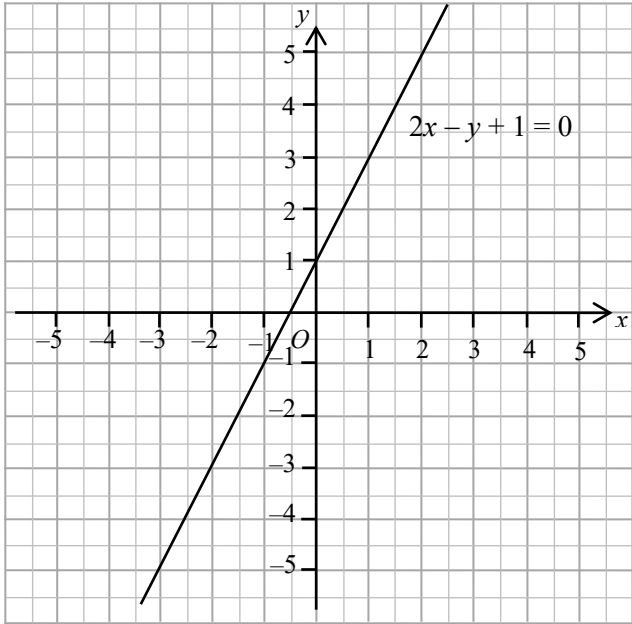19. A (9ME2-20)
20. C (9ME4-20)

Section B – Sub-paper 3 (9ME3)
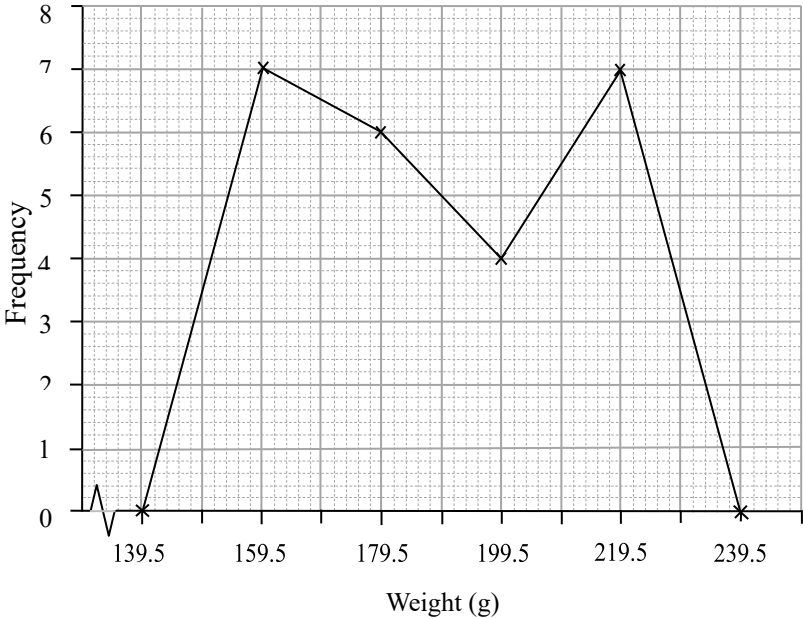
Question Number	Suggested Answers	Marks	Notes
21. (9ME2-21)	36	1	
22. (9ME2-22)	-3	1	
23.		1	(Acceptable range: Between 0 and -0.5)
24. (9ME4-24)	The discount of the cake is __$96__.	1	No need to consider unit
25.	The value of the 3rd term of the sequence is __8__.	1	
26.	1	1	
27. (9ME2-29)	$y^2 - 8y + 16$	1	
28.	$(5x - 1)(5x + 1)$	1	
29.	$c = $ __6__	1	
30.	$x < -2$	1	
31.	$x = $ __85°__	1	No need to consider unit
32.	$x = $ __100°__	1	No need to consider unit
33. (9ME2-35)	$x = $ __40°__	1	No need to consider unit
34.	P and R	1	Must be all correct
35.	$PQ = $ __10__ units	1	
36.	$x = $ __22.2__	1	r.t. 22.2 No need to consider unit

Question Number	Suggested Answers	Marks	Notes
37. (9ME4-37)	**Table 1** Number of vehicles per minute / Frequency 0 – 14 / 2 15 – 29 / 6 30 – 44 / 7	1* (37-1)	Must be all correct
	Table 2 Number of vehicles per minute / Frequency 0 – 8 / 1 9 – 17 / 2 18 – 26 / 5 27 – 35 / 2 36 – 44 / 5	1* (37-2)	Must be all correct

Table 1

Number of vehicles per minute	Frequency
0 – 14	2
15 – 29	6
30 – 44	7

Table 2

Number of vehicles per minute	Frequency
0 – 8	1
9 – 17	2
18 – 26	5
27 – 35	2
36 – 44	5

Question Number	Suggested Answers	Marks	Notes
38. (9ME4-38)	(a) __50__ batteries have been examined in the test.	1 (38a)	
	(b) The median of the lifetime of batteries is __6__ hours in the test.	1 (38b)	
	(c) __5__ batteries do not meet the requirement in the test.	1 (38c)	
39.	The weighted mean score of Simon is __3.9__ .	1	

Section C – Sub-paper 3 (9ME3)

Question Number	Suggested Answers	Marks	Notes
40.	Interest $=$ $5\,000 \times (1 + 8\%)^2 - \$5\,000$ $=$ $832	1 (40-1) 1* (40-2) 1** (40-3)	
41.		1* (42-1) 1 (42-2) 1* (42-3)	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 (0, 1) and the range of x must include the values from –3 to 2. 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
42. (9ME2-42)	$\begin{cases} y = 3x + 8 & ...(1) \\ x + y = 4 & ...(2) \end{cases}$ Substitute (1) into (2), $x + 3x + 8 = 4$ $\qquad 4x = -4$ $\qquad\ x = -1$ Substitute $x = -1$ into (1), $\qquad y = 3(-1) + 8$ $\qquad y = 5$	 1 (42-1) 1* (42-2) 1 (42-3) 1* (42-4)	 Correct method (eliminating one of the variables) Correct value of x (or y) Correct method Both values are correct
43. (9ME2-43)	$x = 2\pi(4) \times \dfrac{95°}{360°}$ ≈ 6.632251 $= 6.63$ cm (corr. to 3 sig. fig.)	1 (43-1) 1* (43-2) 1** (43-3)	 r.t. 6.63 cm
44.	$h = 768 \div 64$ $\ = 12$	1 (44-1) 1* (44-2)	
45. (9ME4-42)	$x + 45° = 3x - 75°$ $\quad 2x = 120°$ $\quad\ x = 60°$	1 (45-1) 1* (45-2)	
46.	$\dfrac{CE}{CA} = \dfrac{15}{5} = 3$ $\dfrac{CD}{CB} = \dfrac{9}{3} = 3$ $\therefore \dfrac{CE}{CA} = \dfrac{CD}{CB} = 3$ $\angle ACB = \angle ECD \qquad$ (vert. opp. $\angle$s) $\therefore \triangle CAB \sim \triangle CED \qquad$ (ratio of 2 sides, inc. $\angle$)		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	

Question Number	Suggested Answers	Marks	Notes
47.	(a) | Weight (g)	Class mark (g)	Frequency
---	---	---
150 – 169	159.5	7
170 – 189	179.5	6
190 – 209	199.5	4
210 – 229	219.5	7 | (b) **Weight of 24 tomatoes**	1* (47a) 1 (47b1) 1* (47b2)	 The remaining 3 points are indicated according to the table above. The points are connected by line segments to form a frequency polygon. Correct frequency polygon (including correct indication of all 3 points and the points are connected by line segments)

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Steps that may be skipped are shown in shade.

Alternative suggested answers are shown in boxes.

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

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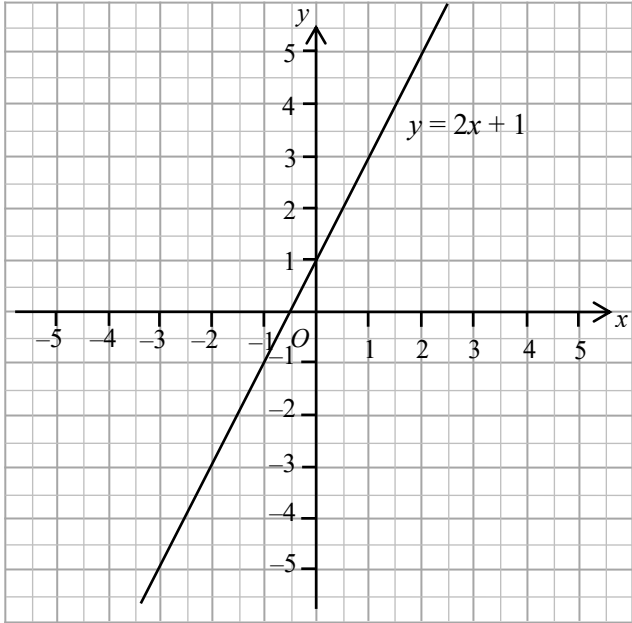17. D   (9ME3-18)
18. C
19. B   (9ME1-20)
20. C   (9ME3-20)

Section B – Sub-paper 4 (9ME4)

Question Number	Suggested Answers	Marks	Notes
21.	5^3	1	
22.	$A = -5$ $B = -2$ $C = 1 / +1$	1	Must be all correct
23.	382 000	1	
24. (9ME3-24)	The discount of the cake is __$96__.	1	No need to consider unit
25.	Number of orange jelly candies : Number of yellow jelly candies = __2__ : __3__	1	
26.	1	1	
27. (9ME1-27)	$x^2 + 4x - 5$	1	
28.	$3x^2 - 12x$	1	
29. (9ME1-26)	$(x + 6)^2$	1	
30. (9ME1-29)	$\dfrac{5}{2x}$	1	
31. (9ME1-30)	$x < -7$	1	
32.	The percentage error of the measured value is __0.625%__ .	1	
33.	$x =$ __50°__	1	No need to consider unit
34.	(a) $x =$ __8__ (b) $y =$ __30__	1	Must be all correct No need to consider unit
35.	$x =$ __50°__	1	No need to consider unit
36.	The coordinates of Q' are (__-3__ , __0__) .	1	Must be all correct

Question Number	Suggested Answers	Marks	Notes
37. (9ME3-37)	**Table 1** 	Number of vehicles per minute	Frequency
---	---
0 – 14	2
15 – 29	6
30 – 44	7	 **Table 2** 	Number of vehicles per minute	Frequency
---	---
0 – 8	1
9 – 17	2
18 – 26	5
27 – 35	2
36 – 44	5		1* (37-1) 1* (37-2)	Must be all correct Must be all correct
38. (9ME3-38)	(a) __50__ batteries have been examined in the test. (b) The median of the lifetime of batteries is __6__ hours in the test. (c) __5__ batteries do not meet the requirement in the test.	1 (38a) 1 (38b) 1 (38c)	
39.	The modal class of the amount of "Consumption Voucher" spent by the 36 people is $ __4 001__ – $ __5 000__ .	1	Must be all correct

Section C – Sub-paper 4 (9ME4)

Question Number	Suggested Answers	Marks	Notes
40.	The amount that Peter should receive $= \dfrac{86\,000 \times 6.5}{100}$ $=\ 5\,590$ Hong Kong dollars	1 (40-1) 1* (40-2) 1** (40-3)	
41. (9ME1-42)	<table><tr><td>x</td><td>−3</td><td>0</td><td>2</td></tr><tr><td>y</td><td>−5</td><td>1</td><td>5</td></tr></table> 	1* (41-1) 1 (41-2) 1* (41-3)	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 (0, 1) and the range of x must include the values from −3 to 2. 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.
42. (9ME3-45)	$x + 45° = 3x − 75°$ $\quad\ 2x = 120°$ $\qquad x = 60°$	1 (42-1) 1* (42-2)	

Question Number	Suggested Answers	Marks	Notes
43.	$AE = DE$ (Given) $\angle BAE = \angle CDE$ (Given) $\angle AEB = \angle DEC$ (vert. opp. $\angle$s) $\therefore \triangle ABE \cong \triangle DCE$ (ASA)		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

Question Number	Suggested Answers	Marks	Notes
44. (9ME1-45)	$AB = \sqrt{2.4^2 + 7^2}$ = 7.4 cm The perimeter of the rhombus = 4×7.4 = 29.6 cm	1 (44-1) 1* (44-2) 1** (44-3)	
45. (9ME1-46)	The area of $\triangle ABC$ = $\dfrac{[2 - (-4)] \times (6 - 1)}{2}$ = 15 sq. units	1 (45-1) 1* (45-2) 1** (45-3)	Or other correct methods
46.	(a) <table><tr><td>Result (Mark)</td><td>1 – 20</td><td>21 – 40</td><td>41 – 60</td><td>61 – 80</td><td>81 – 100</td></tr><tr><td>Class Mark (Mark)</td><td>10.5</td><td>30.5</td><td>50.5</td><td>70.5</td><td>90.5</td></tr><tr><td>Frequency</td><td>5</td><td>8</td><td>12</td><td>4</td><td>1</td></tr></table> (b) The mean = $\dfrac{10.5 \times 5 + 30.5 \times 8 + 50.5 \times 12 + 70.5 \times 4 + 90.5 \times 1}{5 + 8 + 12 + 4 + 1}$ = 42.5 marks	1* (46a) 1 (46b1) 1* (46b2) 1** (46b3)	Must be all correct Correct method

Question Number	Suggested Answers	Marks	Notes
47.	(a)	1* (47a)	Must be all correct
	(b) The probability that Kelvin chooses watermelon shaved ice with nuts = $\frac{1}{9}$	1* (47b)	Or 0.111

(a) Shaved ice flavor

		Watermelon (W)	Strawberry (S)	Chocolate (C)
Topping	Nuts (N)	NW	NS	NC
	Marshmallows (M)	MW	MS	MC
	Biscuit (B)	BW	BS	BC