Education Bureau
Territory-wide System Assessment 2016
Secondary 3 Mathematics
Marking Scheme

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

*Mark for Answer:
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   (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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   (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*".
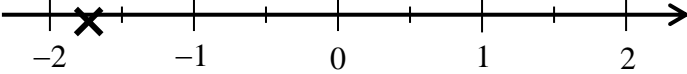
Steps that may be skipped are shown in shade.

Alternative suggested answers are shown in boxes.

Section A – Sub-paper 1 (9ME1) (1 mark each)
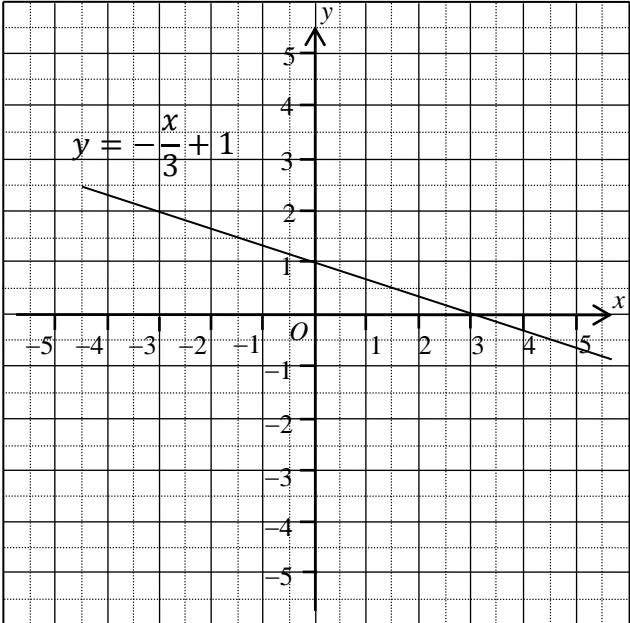
1.   D   (9ME2-1)
2.   B   (9ME4-2)
3.   B
4.   D
5.   D
6.   A
7.   A   (9ME4-7)
8.   C   (9ME3-8)
9.   A
10.   A   (9ME2-10)
11.   B
12.   B
13.   B   (9ME4-13)
14.   C   (9ME3-14)
15.   A   (9ME2-15)
16.   D   (9ME4-16)
17.   C   (9ME4-17)
18.   D
19.   C
20.   C

Section B – Sub-paper 1 (9ME1)

Question Number	Suggested Answers	Marks	Notes
21. (9ME2-21)	(i) −7 (ii) +1 ╱ 1	1	Must be all correct
22.		1	(Acceptable range: $-2 < -\sqrt{3} < -1.5$)
23.	The required weight of butter is __90__ g。	1	
24. (9ME4-24)	$a =$ __2__	1	
25. (9ME2-25)	The value of the 12th term of the sequence is $\dfrac{1}{25}$.	1	or 0.04
26.	$x^2 - xy + x$	1	
27.	$(x+2)(x+4)$	1	
28. (9ME4-28)	approximate solution	1	
29. (9ME2-29)	$K =$ __− 9__	1	
30.	The radius of the circle is __14__ cm.	1	
31.	P, R	1	Must be all correct
32.	(a) $\triangle LMN \sim \triangle PQR$ (b) Ratio of 2 sides, included angle	1	Must be all correct
33.	$x =$ __70__	1	No need to consider unit
34.	BC ╱ CB	1	
35. (9ME2-35)	The polar coordinates of point A are (__4__ , __240°__)。	1	Must be all correct and in order
36.	$AB =$ __26__ units	1	
37.	(a) $x =$ __54__ (b) (i) The total number of participants is __60__ . (ii) The number of S1 participants is __15__ .	1 (37a) 1 (37b1) 1 (37b2)	
38.	The modal class of the prices of the washing machines is $__5000__ – $__5999__ .	1	
39.	The required probability $= \dfrac{1}{4}$	1	or 0.25

Section C – Sub-paper 1 (9ME1)

Question Number	Suggested Answers	Marks	Notes
40.	$PB^2 = PA^2 + AB^2$ $= 17.2^2 + 12.9^2$ $= 462.25$ $PB = 21.5$ $\therefore$ The distance between P and B is 21.5 km.	1 (40-1) 1* (40-2) 1** (40-3)	
41.	The present value of the ring $= 54800 \times (1 + 10\%)^2$ $= \$66308$ $\therefore$ The present value of the ring is \$66308. OR $\boxed{54800 \times 1.1 = 60280}$ $\boxed{60280 \times 1.1 = 66308}$ The present value of the ring is \$66308.	1 (41-1) 1* (41-2) 1** (41-3) $\boxed{1 \ (41\text{-}1)}$ $\boxed{1^* \ (41\text{-}2)}$ $\boxed{1^{**} \ (41\text{-}3)}$	$\boxed{\text{Correct method}}$ $\boxed{\text{(multiply 1.1 twice)}}$
42.	$\begin{cases} y = 4x + 9 & ...(1) \\ y = 3x + 1 & ...(2) \end{cases}$ Substitute (2) into (1): $4x + 9 = 3x + 1$ $4x - 3x - 1 + 9 = 0$ $x = -8$ Substitute $x = -8$ into (2) $y = 3(-8) + 1$ $y = -23$	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. (9ME2-47)	**Table 1** <table><tr><td>Time taken (s)</td><td>Frequency</td></tr><tr><td>51 – 60</td><td>8</td></tr><tr><td>61 – 70</td><td>9</td></tr><tr><td>71 – 80</td><td>3</td></tr></table>	1* (43-1)	Must be all correct

Question Number	Suggested Answers	Marks	Notes
43. (9ME2-47)	<table><tr><td colspan="2">Table 2</td></tr><tr><td>Time taken (s)</td><td>Frequency</td></tr><tr><td>51 – 55</td><td>3</td></tr><tr><td>56 – 60</td><td>5</td></tr><tr><td>61 – 65</td><td>5</td></tr><tr><td>66 – 70</td><td>4</td></tr><tr><td>71 – 75</td><td>2</td></tr><tr><td>76 – 80</td><td>1</td></tr></table>	1* (43-2)	Must be all correct
44. (9ME4-44)	<table><tr><td>x</td><td>– 3</td><td>0</td><td>3</td></tr><tr><td>y</td><td>2</td><td>1</td><td>0</td></tr></table> 	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 (–3, 2) and the range of x must include the values from – 3 to 3. Correct straight line (include: correct position, use ruler to draw the line, pass through the 3 points and extend two ends of the line) If the data in the table is correct but not complete and the graph is correct, (0, 1, 1) can be given.

Question Number	Suggested Answers	Marks	Notes
45.	(Need to find the approximation for the number of participating students in each form.) Total number of participating students $= 11 + 32 + 63$ $\geq 10 + 30 + 60$ $= 100$ $\therefore$ The participating students can get the group discount.	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 approximation for the number of participating students in each form
		1 0 Partial evidence of using estimation strategies, but the solution is incomplete or contains errors	◆ Approximate the number of participating students in each form correctly, but the total number of participating students is omitted or wrongly estimated ◆ Estimate the total number of participating students correctly, but the conclusion is omitted or wrong ◆ Correct method used, but minor 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. (9ME2-46)	$\angle EFG + 300° = 360°$ ($\angle$s at a pt.) $\angle EFG = 60°$ $\because \angle EFG + \angle FGH = 60° + 120°$ $\qquad\qquad = 180°$ $\therefore FE \,/\!/\, GH$ (int. $\angle$s supp.)		Or other correct proofs

Conditions	
(1) Any correct proof with correct reasons	3
(2) Any correct proof with poor presentation or without 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. (9ME4-47)		1* (47-1) 1* (47-2)	For the correct indication of all 4 marks Correct frequency polygon (including the points connected by line segments)

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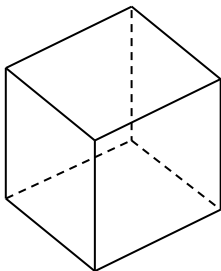
Steps that may be skipped are shown in shade.

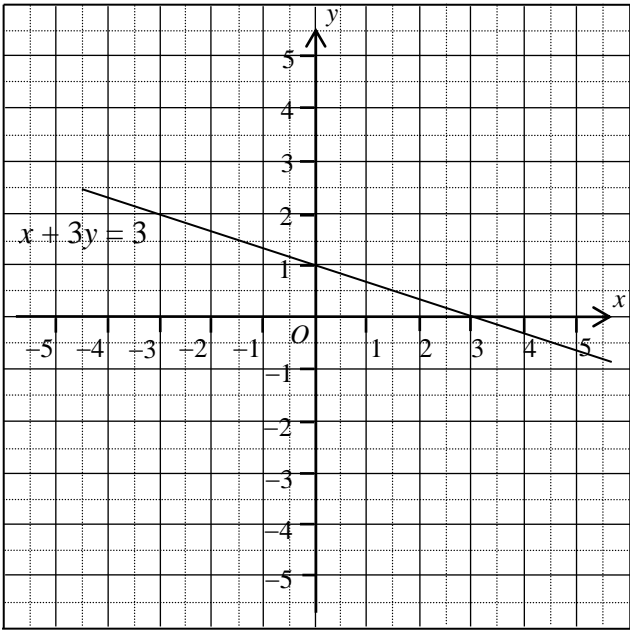Alternative suggested answers are shown in boxes.

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

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

Section B – Sub-paper 2 (9ME2)

Question Number	Suggested Answers	Marks	Notes
21. (9ME1-21)	(i) −7 (ii) +1 ╱ 1	1	Must be all correct
22. (9ME3-22)	8.990	1	
23.	Amy takes __4__ hours to walk 18 km.	1	
24.	$x =$ __25__ $y =$ __36__	1	Must be all correct
25. (9ME1-25)	The value of the 12th term of the sequence is $\dfrac{1}{25}$.	1	or 0.04
26.	$x(x+5)$	1	
27.	$x =$ __6__	1	
28.	$a^2 -100$	1	
29. (9ME1-29)	$K =$ __− 9__	1	
30. (9ME3-30)	$x \le 30$	1	
31.	The side length of the cube is __7__ cm.	1	
32.	A, B	1	Must be all correct
33.	$x =$ __124__	1	No need to consider unit
34.		1	
35. (9ME1-35)	The polar coordinates of point A are (__4__ , __240°__).	1	Must be all correct and in order
36.	$\theta =$ __20.8°__	1	r.t. 20.8° No need to consider unit
37. (9ME3-37)	(3) → (1) → (4) → (2)	1	
38.	(a) There are __20__ sunflowers in the garden. (b) The mode of the heights of the sunflowers is __45__ cm. (c) __13__ sunflowers in the garden are over 40 cm in height.	1* (38a) 1* (38b) 1* (38c)	
39.	The required empirical probability $= \dfrac{13}{100}$	1	or 0.13

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Section C – Sub-paper 2 (9ME2)

Question Number	Suggested Answers	Marks	Notes
40.	The interest $= 6800 \times 2\% \times 3$ $\qquad\qquad = \$408$	1 (40-1) 1* (40-2) 1** (40-3)	
41.	The volume of the prism $=\dfrac{(4+6)\times 3}{2}\times 12$ $= 180 \text{ cm}^3$	1 (41-1) 1* (41-2) 1** (41-3)	
42. (9ME3-42)	The area of the sector $=\pi(7^2)\left(\dfrac{210°}{360°}\right)$ ≈ 89.79719002 $= 89.8 \text{ cm}^2$ (corr. to the nearest 0.1 cm^2)	1 (42-1) 1* (42-2) 1** (42-3)	r.t. 89.8 cm^2
43.	$x + 100° = 3x + 30°$ $2x = 70°$ $x = 35°$	1 (43-1) 1* (43-2) 1** (43-3)	
44. (9ME3-44)	 	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 (–3, 2) and the range of x must include the values from – 3 to 3. Correct straight line (include: correct position, use ruler to draw the line, pass through the 3 points and extend two ends of the line) If the data in the table is correct but not complete and the graph is correct, (0, 1, 1) can be given.

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4

Question Number	Suggested Answers	Marks	Notes
45.	By observation, the depth of water is about $\frac{1}{3}$ of the height of the glass. Volume of water $\approx (525 \times \frac{1}{3})$ cm^3/mL $= 175$ cm^3/mL	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 errors	◆ Using reasonable estimation strategies, but the solution is incomplete. For instance, estimate the depth of water is about $\frac{1}{3}$ of the height of the glass only. ◆ The explanation is reasonable, but the answer is outside the acceptable range ◆ The explanation is reasonable, but minor errors occurred
		1 1 Estimate with reasonable justification	◆ The answer must be supported by reasonable explanation and within the acceptable range ◆ The height of the glass can be estimated as 2.5 times to 3.5 times the depth of water ◆ Acceptable range of the volume: 150 cm^3/mL to 210 cm^3/mL
46. (9ME1-46)	$\angle EFG + 300° = 360°$ ($\angle$s at a pt.) $\angle EFG = 60°$ $\because \angle EFG + \angle FGH = 60° + 120°$ $= 180°$ $\therefore FE // GH$ (int. $\angle$s supp.)		Or other correct proofs

Conditions	
(1) Any correct proof with correct reasons	3
(2) Any correct proof with poor presentation or without 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. (9ME1-43)	**Table 1** 	Time taken (s)	Frequency
---	---
51 – 60	8
61 – 70	9
71 – 80	3		1* (47-1)	Must be all correct
	Table 2 	Time taken (s)	Frequency
---	---
51 – 55	3
56 – 60	5
61 – 65	5
66 – 70	4
71 – 75	2
76 – 80	1		1* (47-2)	Must be all correct

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Section A – Sub-paper 3 (9ME3) (1 mark each)
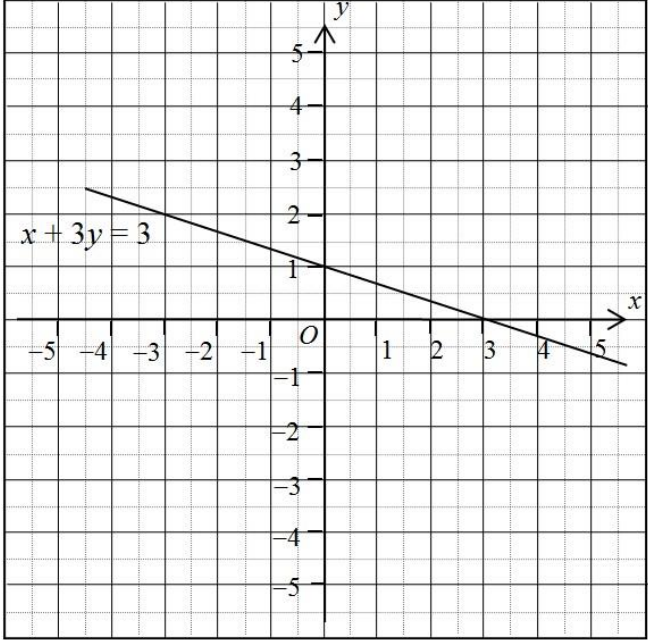
1. B (9ME4-1)
2. A (9ME2-2)
3. D
4. D
5. A (9ME4-5)
6. B
7. D
8. C (9ME1-8)
9. C
10. B
11. A (9ME4-11)
12. B (9ME2-12)
13. D
14. C (9ME1-14)
15. C
16. C
17. A
18. D (9ME2-18)
19. B
20. A (9ME2-20)

Section B – Sub-paper 3 (9ME3)

Question Number	Suggested Answers	Marks	Notes
21.	$A = -3$ $B = 1/+1$ $C = 5/+5$	1	Must be all correct
22. (9ME2-22)	8.990	1	
23. (9ME4-23)	The number of red marbles : the number of green marbles $=$ _5_ : _7_	1	
24.	$n + 1$	1	
25.	$11a + 2$	1	
26.	$m^2 + 2m$	1	
27. (9ME4-27)	$(x+4)(x-4)$ ／ $(x-4)(x+4)$	1	
28.	$\dfrac{1}{x^2}$	1	
29. (9ME4-29)	$H = 2G - 3$	1	
30. (9ME2-30)	$x \le 30$	1	
31.	Figure A: _5_ Figure B: _1_	1 (31-1) 1 (31-2)	
32.	(a) $x = 30$ (b) $y = 12$	1	Must be all correct No need to consider unit
33.	$x = 30°$	1	No need to consider unit
34.	$\angle BCH$ or $\angle HCB$ or $\angle ADE$ or $\angle EDA$	1	
35.	The coordinates of point A are (_−3_ , _0_).	1	Must be all correct
36.	$x = 12.8$	1	r.t. 12.8
37. (9ME2-37)	(3) → (1) → (4) → (2)	1	
38.	Median = _15_ °C	1	
39. (9ME4-39)	The weighted mean mark of Mary is _81_ .	1	

Section C – Sub-paper 3 (9ME3)

Question Number	Suggested Answers	Marks	Notes
40.	$y^6\left(\dfrac{3}{y}\right)^2$ $= y^6 \cdot \dfrac{9}{y^2}$ $= 9y^{6-2}$ $= 9y^4$	1 (40-1) 1 (40-2) 1* (40-3)	Using $\left(\dfrac{x}{y}\right)^m = \dfrac{x^m}{y^m}$ Using $\dfrac{y^m}{y^n} = y^{m-n}$ Correct answer (getting marks 1 1 1)
41. (9ME4-41)	The amount $= 15625 \times (1 + 4\%)^3$ $= \$17576$	1 (41-1) 1* (41-2) 1** (41-3)	
42. (9ME2-42)	The area of the sector $= \pi(7^2)\left(\dfrac{210°}{360°}\right)$ ≈ 89.79719002 $= 89.8\,\text{cm}^2$ (corr. to the nearest 0.1 cm^2)	1 (42-1) 1* (42-2) 1** (42-3)	r.t. 89.8 cm^2
43.	The area of $\triangle ABC$ $= \dfrac{(5-3) \times (4-1)}{2}$ $= 3$ sq. units	1 (43-1) 1* (43-2) 1** (43-3)	

4

Question Number	Suggested Answers	Marks	Notes
44. (9ME2-44)	<table><tr><td>x</td><td>-3</td><td>0</td><td>3</td></tr><tr><td>y</td><td>2</td><td>1</td><td>0</td></tr></table> $x + 3y = 3$	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 (−3, 2) and the range of x must include the values from −3 to 3. Correct straight line (include: correct position, use ruler to draw the line, pass through the 3 points and extend two ends of the line) If the data in the table is correct but not complete and the graph is correct, (0, 1, 1) can be given.
45.	The mode of a set of data is the datum with the highest frequency, but it does not imply that the number of appearances of the datum must be more than half of the total. OR Of these 5 players, only 2 of them are 187 cm tall. Therefore, it is not more than half of the 5 players are 187 cm tall. ∴ The coach's statement **is** misleading.	0 0 1 0 1 1	◆ Without any reasonable explanation ◆ Conclusion is incorrect ◆ Explanation is reasonable but incomplete ◆ Explanation is reasonable but no conclusion ◆ Explanation is reasonable and the conclusion is correct

Question Number	Suggested Answers	Marks	Notes
46. (9ME4-46)	$\dfrac{DE}{AB} = \dfrac{8}{4} = 2$ $\dfrac{EF}{BC} = \dfrac{10}{5} = 2$ $\therefore \dfrac{DE}{AB} = \dfrac{EF}{BC}$ $\angle DEF = \angle ABC$ (given) $\therefore \triangle DEF \sim \triangle ABC$ (Ratio of 2 sides, inc. $\angle$)		

	Conditions		
	(1) Any correct proof with correct reasons	3	
	(2) Any correct proof with poor presentation or without 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.	$\tan \angle QPR = \dfrac{QR}{PQ}$ $\tan \angle QPR = \dfrac{7}{3}$ $\angle QPR \approx 66.80140949°$ $\angle QPR = 66.8°$ (corr. to the nearest 0.1°)	1 (47-1) 1* (47-2) 1** (47-3)	r.t. 66.8°

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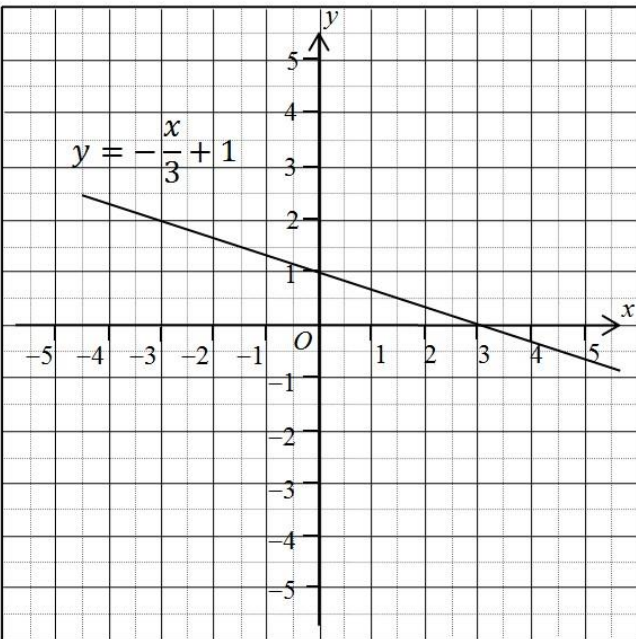
Section A – Sub-paper 4 (9ME4) (1 mark each)

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

Section B – Sub-paper 4 (9ME4)

Question Number	Suggested Answers	Marks	Notes
21.	-3	1	
22.	$\underline{\quad 1.85 \times 10^5 \quad}$ kg	1	
23. (9ME3-23)	The number of red marbles : the number of green marbles $= \underline{\;5\;} : \underline{\;7\;}$	1	
24. (9ME1-24)	$a = \underline{\quad 2 \quad}$	1	
25.	The constant term of the polynomial $5y^2 - 4y + 11$ is $\underline{\;11\;}$.	1	
26.	$y^2 + 4y + 3$	1	
27. (9ME3-27)	$(x+4)(x-4) \diagup (x-4)(x+4)$	1	
28. (9ME1-28)	approximate solution	1	
29. (9ME3-29)	$H = 2G - 3$	1	
30.	$-3.1 \quad \boxed{>} \quad -3.2$	1	
31.	$x < 15$	1	
32.	The order of rotational symmetry is $\underline{\;6\;}$.	1	
33.	(a) $x = 85$ (b) $y = 14$	1	Must be all correct No need to consider unit
34.	$x = \underline{\quad 16 \quad}$	1	No need to consider unit
35.	The coordinates of R' are ($\underline{\;-2\;}$, $\underline{\;4\;}$) 。	1	Must be all correct
36.	The gradient of the path PQ is $\dfrac{1}{4}$.	1	Accept 0.25 or 1 : 4
37.	(i) Continuous data (ii) Discrete data	1	Must be all correct
38.	The upper quartile is $\underline{\;50\;}$ minutes.	1	
39. (9ME3-39)	The weighted mean mark of Mary is $\underline{\;81\;}$.	1	

Section C － Sub-paper 4 (9ME4)

Question Number	Suggested Answers	Marks	Notes
40.	The selling price of the washing machine $= \$5820 \times (1 - 15\%)$ $= \$4947$	1 (40-1) 1* (40-2) 1** (40-3)	
41. (9ME3-41)	The amount $= 15625 \times (1 + 4\%)^3$ $= \$17576$	1 (41-1) 1* (41-2) 1** (41-3)	
42.	The length of $\overset{\frown}{AB} = 2\pi(16)\left(\dfrac{100°}{360°}\right)$ ≈ 27.92526803 $= 27.9$ cm (corr. to 3 sig. fig.)	1 (42-1) 1* (42-2) 1** (42-3)	 r.t. 27.9 cm
43.	The surface area of the sphere $= 4\pi \times \left(\dfrac{14}{2}\right)^2$ ≈ 615.7521601 $= 615.8$ cm^2 (corr. to the nearest 0.1 cm^2)	1 (43-1) 1* (43-2) 1** (43-3)	 r.t. 615.8 cm^2
44. (9ME1-44)	<table><tr><td>x</td><td>-3</td><td>0</td><td>3</td></tr><tr><td>y</td><td>2</td><td>1</td><td>0</td></tr></table> $y = -\dfrac{x}{3} + 1$	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 (-3, 2) and the range of x must include the values from -3 to 3. Correct straight line (include: correct position, use ruler to draw the line, pass through the 3 points and extend two ends of the line) If the data in the table is correct but not complete and the graph is correct, (0, 1, 1) can be given.

Question Number	Suggested Answers	Marks	Notes
45.	(a) 	1* (45a) 1 (45b1) 1* (45b2) 1** (45b3)	Must be all correct Correct method
46. (9ME3-46)			

(a)

Transportation expenses ($)	0 – 14	15 – 29	30 – 44	45 – 59
Class mark	7	22	37	52
Frequency	5	18	20	7

(b) The mean = $\dfrac{7\times5+22\times18+37\times20+52\times7}{50}$

$\qquad\qquad = \$30.7$

46. (9ME3-46)

$\dfrac{DE}{AB} = \dfrac{8}{4} = 2$

$\dfrac{EF}{BC} = \dfrac{10}{5} = 2$

$\therefore \dfrac{DE}{AB} = \dfrac{EF}{BC}$

$\angle DEF = \angle ABC$ (given)

$\therefore \triangle DEF \sim \triangle ABC$ (Ratio of 2 sides, inc. $\angle$)

Conditions	
(1) Any correct proof with correct reasons	3
(2) Any correct proof with poor presentation or without 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. (9ME1-47)	**High jump records of 80 students** 	1* (47-1) 1* (47-2)	For the correct indication of all 4 marks Correct frequency polygon (including the points connected by line segments)