Neap

Final Examination 2021

NSW Year 11 Mathematics Standard

Solutions and marking guidelines

Section I

Answer and explanation	Syllabus content, outcomes and targeted performance bands
Question 1 **C** There are 4 blue discs in the container (10 – 4 – 2 = 4). Therefore, the probability of selecting a blue disc is $\frac{4}{10}=\frac{2}{5}$.	MS–S2 Relative Frequency and Probability MS11–8 Bands 1–2
Question 2 **A** Using the unitary method gives: $\frac{10}{110}\times 30 = \$2.7272\ldots$ $\approx \$2.73$ Rian pays $2.73 in GST rounded to the nearest cent.	MS–F1 Money Matters MS11–5 Bands 1–2
Question 3 **B** **B** is correct. Using the straight-line method gives: $S = V_0 - Dn$ $60\,000 = 75\,000 - 5000n$ $60\,000 - 75\,000 = -5000n$ $-15\,000 = -5000n$ $n = 3$ Therefore, it took three years for the salvage value to reach $60 000. Alternatively, $S = 75\,000 - 5\,000n$. The solution can be obtained by substituting each option for n. **B** is correct. $75000 - 5000\times 3 = 60000$ **A** is incorrect. $75000 - 5000\times 2 = 65000$ **C** is incorrect. $75000 - 5000\times 4 = 55000$ **D** is incorrect. $75000 - 5000\times 5 = 50000$	MS–F1 Money Matters MS11–5 Bands 1–2
Question 4 **C** The difference between the cities' longitudes is 75 + 30 = 105°. $\frac{105}{15} = 7$ hours Nicosia is 7 hours ahead of New York. Therefore, when it is 7:00 am in New York, it is 2:00 pm in Nicosia (7:00 am + 7 hours = 2:00 pm).	MS–M2 Working with Time MS11–3 Bands 2–3
Question 5 **B** **B** is correct. The gradient of the graph is 3. Hence, the line must slope to the right. Therefore, **C** and **D** are incorrect. **A** is incorrect. The y-intercept is 2, so the graph must have a positive y-intercept.	MS–A2 Linear Relationships MS11–2 Bands 2–3

Answer and explanation	Syllabus content, outcomes and targeted performance bands
Question 6 C **C** is correct. Population statistical measures are represented by Greek letters. μ represents population mean. **A** is incorrect. *s* represents sample standard deviation. **B** is incorrect. σ represents population standard deviation. **D** is incorrect. $\bar{x}$ represents sample mean.	MS–S1 Data Analysis MS11–2 Bands 2–3
Question 7 C Andrea takes three adult doses of the medicine in a 24-hour period. Hence, she consumes 25 mL per dose $\left(\frac{75}{3}=25\right)$. A child who is one-and-a-half years old is 18 months old. Substituting this into Fried's formula gives: $\text{dosage for children 1–2 years} = \frac{18\times 25}{150}$ $= \frac{450}{150}$ $= 3 \text{ mL}$	MS–A1 Formulae and Equations MS11–1 Bands 3–4
Question 8 D Yvonne paid \$76.75 for 48 litres of fuel. The product of 48 and the price of petrol in cents per litre must equal \$76.75. Let *x* be the price of petrol per litre. Solving for *x* gives: $48x = 76.75$ $x = \frac{76.75}{48}$ $= 1.599 = 159.9 \text{ cents}$ Hence, Yvonne used Diesel fuel. Alternatively, the solution can be obtained by substituting the price of each petrol in cents. **D** is correct. $48\times 1.599 = 76.752$ $\approx \$76.75$ **A** is incorrect. $48\times 1.709 = \$82.032$ **B** is incorrect. $48\times 1.649 = \$79.152$ **C** is incorrect. $48\times 1.579 = \$75.792$	MS–F1 Money Matters MS11–6 Bands 4–5

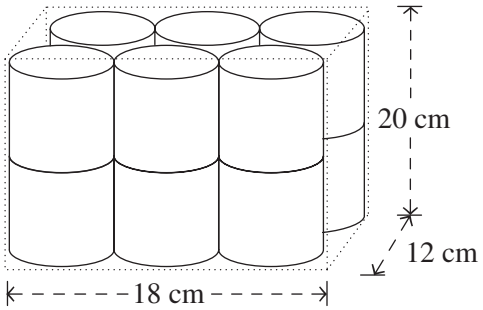
Answer and explanation	Syllabus content, outcomes and targeted performance bands
Question 9 **C** Hugh and Louis must earn the same amount. This is represented by the following expression. $300 + 0.035 \times \_\_\_ = 0.05 \times \_\_\_$ Let x be the value of sales. Solving for x gives: $300 + 0.035x = 0.05x$ $300 = 0.05x - 0.035x$ $300 = 0.015x$ $x = \frac{300}{0.015}$ $= \$20\,000$ Hence, Hugh and Louis must each make \$20 000 worth of sales to earn the same amount (\$1000). Alternatively, the solution can be obtained by substituting each option into the expression. **C** is correct. $300 + 0.035 \times 20\,000 = 0.05 \times 20\,000$ $1000 = 1000$ **A** is incorrect. $300 + 0.035 \times 5000 \neq 0.05 \times 5000$ **B** is incorrect. $300 + 0.035 \times 10\,000 \neq 0.05 \times 10\,000$ **D** is incorrect. $300 + 0.035 \times 30\,000 \neq 0.05 \times 30\,000$	MS–F1 Money Matters MS11–5 Bands 3–4
Question 10 **D** The rate and n must be expressed in the same units. • four years = 48 months • 0.5% = 0.005 $I = Prn$ $= 9000 \times 0.005 \times 48$	MS–F1 Money Matters MS11–5 Bands 3–4
Question 11 **C** capacity $= 76.5 \times 1000$ $= 76\,500 \text{ cm}^3$ $V = 85 \times 45 \times h$ $76\,500 = 85 \times 45 \times h$ $h = \frac{76\,500}{3825}$ $= 20 \text{ cm}$	MS–M1 Applications of Measurement MS11–4 Bands 4–5

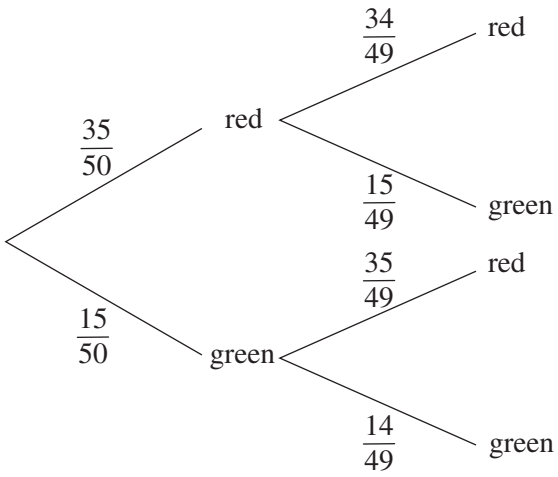
Answer and explanation	Syllabus content, outcomes and targeted performance bands
Question 12 **A** The Johnsonia High School box-plot represents 200 students. Half of those students (two quartiles) spent 20–30 hours learning to drive with instructors. This means 100 students from Johnsonia High School had 20–30 hours of driving lessons. Therefore, 100 students from Flowerdale High School are represented per quartile as both schools had the same number of students spend between 20–30 hours learning to drive. Hence, the Flowerdale High School box-plot represents 400 students ($100 \times 4 = 400$). The total number of students represented by both box-plots is given by $400 + 200 = 600$.	MS–S1 Data Analysis MS11–10 Bands 5–6
Question 13 **A** • precision = 10 cm • absolute error = 5 cm (half the precision) • measurement = 21 240 cm $\text{percentage error} = \frac{\text{absolute error}}{\text{measurement}} \times 100\%$ $= \frac{5}{21240} \times 100$ $= 0.02354...$ $\approx 0.024\%$	MS–M1 Applications of Measurement MS11–3 Bands 4–5
Question 14 **C** The sample space is shown in the table. The outcomes in bold meet the criteria of at least either the die or the marble showing the number 1. This is nine outcomes out of 24. $P(\text{at least either the die or the marble shows number 1}) = \frac{9}{24}$ $= \frac{3}{8}$	MS–S2 Relative Frequency and Probability MS11–8 Bands 4–5

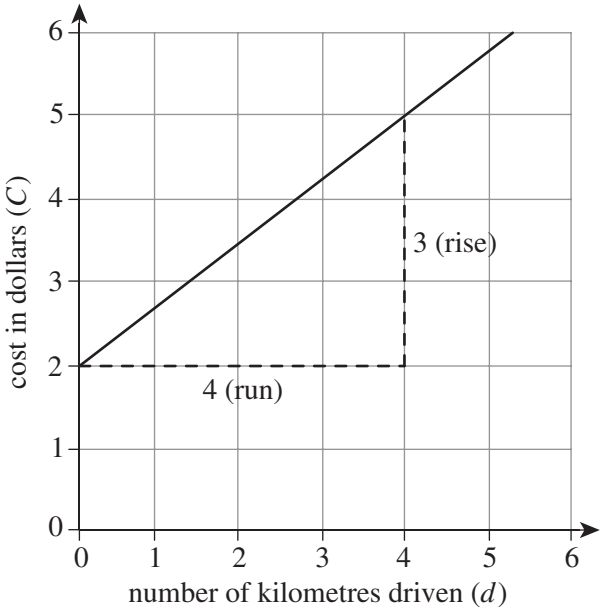
	1	*2*	*3*	*4*	*5*	*6*
1	**1, 1**	**1, 2**	**1, 3**	**1, 4**	**1, 5**	**1, 6**
2	**2, 1**	2, 2	2, 3	2, 4	2, 5	2, 6
3	**3, 1**	3, 2	3, 3	3, 4	3, 5	3, 6
4	**4, 1**	4, 2	4, 3	4, 4	4, 5	4, 6

Answer and explanation	Syllabus content, outcomes and targeted performance bands
Question 15 B *OB* is 12 cm as it is the radius of the circle. Given that the two triangles are similar and two sides of triangle *AOB* are equal in length, the corresponding two sides of triangle *CDB* must also be equal. Hence, if *DB* is 4 cm, then *CD* is 4 cm. Using Pythagoras' theorem in triangle *CDB* gives: $BC^2 = 4^2 + 4^2$ $BC^2 = 32$ $BC = \sqrt{32}$ $= 5.6568...$ Then, using similar triangles gives: $\frac{5.6568...}{x + 5.6568...} = \frac{4}{12}$ $12 \times 5.6568... = 4(x + 5.6568...)$ $67.8822... = 4x + 22.6274...$ $45.2548... = 4x$ $x = 11.3137...$ $\approx 11 \text{ cm}$	MS–M1 Applications of Measurement MS11–4 Bands 5–6

SECTION II

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
Question 16	
Erin's pay for four weeks $= 4600 \times 4$ $= \$18400$ Erin's annual leave loading for four weeks' annual leave $= 0.175 \times 18400$ $= \$3220$ Erin's total pay for four weeks' annual leave $= 18400 + 3200$ $= \$21620$	MS–F1 Money Matters MS11–5 Bands 1–2 • Gives the correct solution . . . . . .2 • Calculates four week's pay OR calculates 17.5% of one week's pay 1
Question 17	
(a) $A = \pi r^2 + 2\pi rh$ $= \pi \times 3^2 + 2 \times \pi \times 3 \times 10$ $= 216.7698...$ $\approx 216.77 \text{ cm}^2$	MS–M1 Applications of Measurement MS11–4 Bands 1–2 • Calculates the surface area correct to two decimal places . . . . .2 • Calculates the surface area of a cylinder. 1
(b) A box is two glasses high, hence the height of a box is 20 cm. A box is two glasses wide, hence the width of a box is 12 cm. A box is three glasses long, hence the length of a box is 18 cm ($3 \text{ cm} \times 2 \times 3$ glasses).  The surface area of one box is given by: $(20 \text{ cm} \times 12 \text{ cm} \times 2) + (20 \text{ cm} \times 18 \text{ cm} \times 2) +$ $(12 \text{ cm} \times 18 \text{ cm} \times 2) = 1632 \text{ cm}^2$ *Note: Responses do not require a diagram.*	MS–M1 Applications of Measurement MS11–4 Bands 2–3 • Gives the correct solution . . . . . .2 • Calculates the surface area of a rectangular prism using incorrect dimensions 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
Question 18	
(a) There are 50 lollies in total (35 + 15). relative frequency of Henry selecting a green lolly $= \frac{15}{50}$ $= \frac{3}{10}$	MS–S2 Relative Frequency and Probability MS11–8 Bands 1–2 • Gives the correct solution 1
(b) 	MS–S2 Relative Frequency and Probability MS11–8 Bands 2–3 • Writes the correct probabilities on every branch . . . . . .2 • Writes the correct probabilities on at least two branches. 1
(c) P(selecting at least one green lolly) $= \left(\frac{35}{50} \times \frac{15}{49}\right) + \left(\frac{15}{50} \times \frac{35}{49}\right) + \left(\frac{15}{50} \times \frac{14}{49}\right)$ $= \frac{18}{35}$ Alternatively, the solution can be obtained using the complementary events method: $1 - P(\text{both red}) = 1 - P\left(\frac{35}{50} \times \frac{34}{49}\right)$ $= \frac{18}{35}$	MS–S2 Relative Frequency and Probability MS11–8 Bands 3–4 • Gives the correct solution . . . . . .2 • Makes significant progress 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
Question 19	
(a)  $\text{gradient} = \frac{\text{rise}}{\text{run}}$ $= \frac{3}{4}$ $= 0.75$ The gradient 0.75 indicates that customers are charged 75 cents per kilometre travelled.	MS–A2 Linear Relationships MS11–6 Bands 2–3 • Calculates the gradient correctly and explains what the gradient indicates . . . . . .2 • Calculates the gradient correctly OR correctly explains what the gradient indicates using an incorrect gradient. 1
(b) The y-intercept is 2. The equation of the line is $C = 0.75d + 2$.	MS–A2 Linear Relationships MS11–2 Bands 2–3 • Gives the correct solution 1
(c) Solving the equation $C = 0.75d + 2$ for $C = 18.2$ gives: $18.2 = 0.75d + 2$ $16.2 = 0.75d$ $d = 21.6$ km The customer travelled 21.6 km in the rideshare car.	MS–A2 Linear Relationships MS11–6 Bands 2–3 • Gives the correct solution 1
Question 20	
(a) $\text{Zachary's taxable income} = 127\,550 + 15\,500 - 7250$ $= \$135\,800$	MS–F1 Money Matters MS11–5 Bands 3–4 • Gives the correct solution 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
(b) Zachary's income tax payable $= 17550 + 0.37(135800 - 80000)$ $= \$38196$	MS–F1 Money Matters MS11–5 Bands 3–4 • Gives the correct solution . . . . . .2 • Makes significant progress 1
(c) Medicare levy $= 0.015 \times 135800$ $= \$2037$	MS–F1 Money Matters MS11–5 Bands 2–3 • Gives the correct solution 1
(d) total tax payable = income tax payable + Medicare levy $= 38196 + 2037$ $= \$40233$ Zachary contributes \$39 000 in Pay As You Go (PAYG) tax. Therefore, Zachary has a tax debt calculated as \$40 233 – \$39 000 = \$1233. *Note: Consequential on answer to Question 20 parts (b) and (c).*	MS–F1 Money Matters MS11–5 Bands 3–4 • Calculates total tax payable AND tax debt amount correctly. . . .2 • Calculates total tax payable only OR bases tax debt/refund on income tax payable 1
Question 21	
(a) The mode is 2. The mode indicates that a Smithland High School teacher most often drives through the toll two times each day.	MS–S1 Data Analysis MS11–7 Bands 2–3 • Determines the mode AND explains what the mode indicates correctly . . . . . .2 • Determines the mode correctly OR explains what the mode indicates correctly 1
(b) total amount the teachers spend on tolls $= ((1 \times 3) + (2 \times 22) + (3 \times 5) + (4 \times 2)) \times 5.75$ $= \$402.50$	MS–S1 Data Analysis MS11–10 Bands 3–4 • Gives the correct solution 1
Question 22	
$p = 4r - 2s^2$ $2s^2 = 4r - p$ $s^2 = \frac{4r - p}{2}$ $s = \pm\sqrt{\frac{4r - p}{2}}$	MS–A1 Formulae and Equations MS11–1 Bands 3–4 • Gives the correct solution . . . . . .2 • Makes significant progress 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
Question 23	
(a) $A \approx \frac{20}{2}(30+40)+\frac{20}{2}(40+42)$ $\approx 1520 \text{ m}^2$	MS–M1 Applications of Measurement MS11–4 Bands 2–3 • Gives the correct solution . . . . . .2 • Calculates the area of one trapezium OR shows some understanding of the problem 1
(b) $\frac{1520}{15} = 101.3333 \ldots$ Land tax is charged at a rate of \$5 per 15 m^2 or part thereof, hence \$5 will be paid 102 times. $\text{land tax} = 5 \times 102$ $= \$510$	MS–F1 Money Matters MS11–6 Bands 3–4 • Gives the correct solution . . . . . .2 • Shows some understanding of the problem 1
Question 24	
$H = 4$ hours (7:00–11:00 pm) $N = 5$ standard drinks consumed time for BAC to return to zero = $2\frac{2}{3}$ hours (11:00 pm – 1:40 am) $\text{time} = \frac{\text{BAC}}{0.015}$ $2\frac{2}{3} = \frac{\text{BAC}}{0.015}$ $\text{BAC} = 0.04$ $\text{BAC}_{\text{male}} = \frac{10N - 7.5H}{6.8M}$ $0.04 = \frac{(10 \times 5) - (7.5 \times 4)}{6.8M}$ $0.272M = 50 - 30$ $0.272M = 20$ $M = \frac{20}{0.272}$ $= 73.5294 \ldots$ ≈ 73.53 kilograms	MS–A1 Formulae and Equations MS11–1 Bands 4–5 • Gives the correct solution . . . . . .3 • Makes significant progress . . . . . .2 • Shows some understanding of the problem 1
Question 25	
(a) It is not possible to calculate the range because the highest score and lowest score are not identified.	MS–S1 Data Analysis MS11–10 Bands 4–5 • Gives the correct solution 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
(b) *Number of students* / *Frequency* / *Cumulative frequency* 3 / 3 / 3 8 / 5 / 8 13 / 4 / 12 18 / **3** / 15 23 / **1** / **16**	MS–S1 Data Analysis MS11–7, MS11–2 Bands 3–4 • Gives the correct solution . . . . . .2 • Gives the correct value in one field 1
(c) $\text{mean} = \dfrac{(3\times3)+(8\times5)+(13\times4)+(18\times3)+(23\times1)}{16}$ $= 11.125$	MS–S1 Data Analysis MS11–7 Bands 4–5 • Gives the correct solution 1
Question 26	
1 kg = 1000 g $\dfrac{1000}{1.7\times10^{-3}} = 588\,235.2941$ $\approx 590\,000$ $\approx 5.9\times10^{5}$ grains of rice	MS–M1 Applications of Measurement MS11–3 Bands 4–5 • Gives the correct solution . . . . . .2 • Makes significant progress 1
Question 27	
(a) $c = kl$	MS–A2 Linear Relationships Bands 2–3 MS11–6 • Gives the correct solution 1
(b) $1905.50 = k\times37$ $\dfrac{1905.50}{37} = k$ $k = 51.5$ The new equation is $c = 51.5l$. The length of a fence that costs \$1184.50 to build can be calculated by solving the equation. $1184.50 = 51.5l$ $\dfrac{1184.50}{51.5} = l$ $l = 23$ m Therefore, the fence is 23 metres in length.	MS–A2 Linear Relationships Bands 2–3 MS11–6 • Gives the correct solution . . . . . .2 • Calculates the constant of variation (k) 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
(c) For two variables to directly vary, the value of one of the variables must be equal to a constant multiplied by the other variable. The formula for the cost of building a fence, including the booking fee, is represented by the equation $c = 100 + 51.5l$. This means the cost (a variable) cannot be found by multiplying the constant of variation by the other variable (length) and hence these two variables do not directly vary.	MS–A2 Linear Relationships Bands 4–5 MS11–6 • Gives the correct solution AND a correct justification 1
Question 28	
$12 \text{ mL} = 12 \text{ cm}^3$ $12 \text{ cm}^3 \times 8 = 96 \text{ cm}^3$ $V = \frac{4}{3}\pi r^3$ $96 = \frac{4\pi r^3}{3}$ $288 = 4\pi r^3$ $\frac{288}{4\pi} = r^3$ $r = \sqrt[3]{\frac{288}{4\pi}}$ $= 2.8405...$ $\approx 3 \text{ cm}$	MS–M1 Applications of Measurement MS11–3 Bands 4–5 • Gives the correct solution . . . . . .2 • Makes significant progress 1
Question 29	
(a) lowest score = 9 $Q_1 = 14$ $\text{median} = \frac{15+17}{2}$ $= 16$ $Q_3 = 22$ highest score = 25	MS–S1 Data Analysis MS11–7 Bands 4–5 • Gives the correct solution . . . . . .3 • Gives four correct values. . . . . .2 • Gives three correct values 1
(b) The lower cut-off for outliers can be found as follows: $\text{cut-off} = Q_1 - 1.5 \times IQR$ $= 14 - 1.5 \times 8$ $= 2$ No student listened to fewer than two songs. The upper cut-off for outliers can be found as follows. $\text{cut-off} = Q_3 + 1.5 \times IQR$ $= 22 + 1.5 \times 8$ $= 34$ No student listened to more than 34 songs. Hence, there are no outliers.	MS–S1 Data Analysis MS11–10 Bands 4–5 • Gives the correct solution with calculations . . . . . .2 • Makes significant progress 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
Question 30	
total flying time = 23 hours and 15 minutes *23 hours and 15 minutes flying time* *Depart*: *City* A 9:20 pm Wednesday; *Sydney Coordinated Universal Time (UTC) +10* *Arrive*: *City* A 8:35 pm Thursday; *Sydney Coordinated Universal Time (UTC) +10* 1:35 pm Friday 9:20 pm + 23 hours and 15 minutes = 8:35 pm This means there is a 17-hour time difference between City *A* and Sydney. Hence, the UTC of City *A* is –7.	MS–M2 Working with Time MS11–3, MS11–10 Bands 5–6 • Gives the correct solution . . . . . .3 • Makes significant progress . . . . . .2 • Makes ONE correct calculation such as flying time or arrival time in City *A*. 1
Question 31	
(a) 35 kilojoules per kilogram × 53 kilograms $= 1855$ kilojoules per hour 40 minutes = $\frac{2}{3}$ hour $1855 \times \frac{2}{3} = 1236\frac{2}{3}$ kilojoules Karla did not burn off the energy contained in the serving of chips.	MS–M1 Applications of Measurement MS11–3, MS11–10 Bands 5–6 • Gives the correct solution . . . . . .2 • Makes significant progress 1
(b) 1290 kilojoules = 15% of the daily adult intake 100% of daily adult intake $= \left(\frac{1290}{15}\right) \times 100$ $= 8600$ kJ 100% average adult intake in kilocalories $= \frac{8600}{4.184}$ $= 2055.449$ ≈ 2055 kilocalories	MS–M1 Applications of Measurement MS11–3, MS11–10 Bands 5–6 • Gives the correct solution . . . . . .2 • Makes significant progress 1

Sample answer	Syllabus content, outcomes, targeted performance bands and marking guide
Question 32	
(a) $\text{total number of respondents} = 60 + 40 + 40 + 20 + 10$ $= 170$ $\text{percentage of respondents} = \frac{20}{170} \times 100$ $= 11.7647...$ $\approx 11.76\%$	MS–S1 Data Analysis MS11–7 Bands 4–5 • Gives the correct solution 1
(b) Taking the sum of all the categories to point *X* gives: $60 + 40 + 40 = 140$ $\frac{140}{170} \times 100 = 82.3529...$ $\approx 82.35\%$	MS–S1 Data Analysis MS11–7 Bands 5–6 • Gives the correct solution . . . . . .2 • Calculates the sum of the three most common responses 1
(c) The line graph represents cumulative frequency. Since the increase from point *V* to point *W* is 40 people, and the increase between point *W* and point *X* is 40 people, the line segment from point *V* to point *X* is a straight line due to the constant rate of change.	MS–S1 Data Analysis MS11–10 Bands 5–6 • Gives the correct explanation 1
Question 33	
$\frac{3.6\% \text{ per annum}}{4} = 0.9\% \text{ per quarter}$ *Quarter* | *Principle* | *Interest* | *Principal + interest* 1 | \$4000 | $0.9\% \times 4000 = \$36$ | \$4036.00 2 | \$4036 | $0.9\% \times 4036 = \$36.32$ | \$4072.32 3 | \$4072.32 | ? | \$4113.04 The question asks for the new annual interest rate that was offered to Kayla in the third quarter. $\text{interest in third quarter} = 4113.04 - 4072.32$ $= \$40.72$ $40.72 = \text{interest rate per quarter} \times 4072.32$ $\text{interest rate per quarter} = \frac{40.72}{4072.32}$ $= 0.0099...\%$ $\frac{40.72}{4072.32} \times 100 \times 4 = 3.9996...$ $\approx 4\% \text{ per annum}$	MS–F1 Money Matters MS11–2, MS11–5, MS11–10 Bands 5–6 • Gives the correct solution . . . . . .4 • Makes significant progress . . . . . .3 • Completes TWO calculations correctly . . . . . .2 • Calculates interest of one quarter correctly 1