RATIO

1 **(a)** The angles of a triangle are in the ratio 2 : 3 : 5.

(i) Show that the triangle is right-angled.

[1]

(ii) The length of the hypotenuse of the triangle is 12 cm.

Use trigonometry to calculate the length of the shortest side of this triangle.

..... cm [3]

(b) The sides of a different right-angled triangle are in the ratio 3 : 4 : 5.

(i) The length of the shortest side is 7.8 cm.

Calculate the length of the longest side.

..... cm [2]

(ii) Calculate the smallest angle in this triangle.

..... [3]

MARKING SCHEME:

(a)(i)	$180 \div (2 + 3 + 5) \times 5$ [= 90]	**1**	with no errors seen
(a)(ii)	7.05 or 7.053….	**3**	**M2** for $\frac{x}{12} = \sin 36$ oe or better or **B1** for 36 or 54 seen
(b)(i)	13	**2**	**M1** for $7.8 \div 3$ soi
(b)(ii)	36.9 or 36.86 to 36.87	**3**	**B1** for smallest angle identified **M1** for $\sin[\ ] = \frac{3}{5}$ oe or $\sin[\ ] = \frac{7.8}{\textit{their}\ \textbf{(b)(i)}}$ oe If zero scored, **SC1** for calculation of 53.1

2 Marianne sells photos.

(a) The selling price of each photo is \$6.

(i) The selling price for each photo is made up of two parts, printing cost and profit.
For each photo, the ratio printing cost : profit = 5 : 3.

Calculate the profit she makes on each photo.

\$ ..... [2]

(ii) Calculate her profit as a percentage of the selling price.

.....% [1]

(iii) Calculate the selling price of a photo in euros (€) when the exchange rate is €1 = \$1.091 .

€ ..... [2]

(b) Marianne sells two sizes of photo.
These photos are mathematically similar rectangles.
The smaller photo has length 15 cm and width 12 cm.
The larger photo has area 352.8 cm^2.

Calculate the length of the larger photo.

..... cm [3]

(c) In a sale, Marianne buys a new camera for \$483.
This is a reduction of 8% on the original price.

Calculate the original price of the camera.

\$ ..... [3]

MARKING SCHEME:

(a)(i)	2.25 final answer	**2**	**M1** for $\frac{3}{5+3}$ or $\frac{6}{5+3}$ oe
(a)(ii)	37.5	**1**	**FT** *their* $\frac{\textbf{(a)(i)}}{6}\times 100$
(a)(iii)	5.5[0] or 5.499 to 5.500	**2**	**M1** for $6 \div 1.091$
(b)	21	**3**	**M2** for $15\times\sqrt{\frac{352.8}{15\times 12}}$ oe or **SC2** for answer 16.8 or **M1** for $\sqrt{\frac{352.8}{15\times 12}}$ or $\sqrt{\frac{15\times 12}{352.8}}$ seen or **M1** for a correct implicit statement for the length
(c)	525	**3**	**M2** for $\frac{483}{100-8}[\times 100]$ oe or **M1** for 483 associated with 92 [%]

3 **(a)** The Muller family are on holiday in New Zealand.

(i) They change some euros (€) and receive $1962 (New Zealand dollars).
The exchange rate is €1 = $1.635 .

Calculate the number of euros they change.

€ ..... [2]

(ii) The family spend 15% of their New Zealand dollars on a tour.

Calculate the number of dollars they have left.

$ ..... [2]

(iii) The family visit two waterfalls, the Humboldt Falls and the Bridal Veil Falls.
The ratio of the heights Humboldt Falls : Bridal Veil Falls = 5 : 1.
The Humboldt Falls are 220 m higher than the Bridal Veil Falls.

Calculate the height of the Humboldt Falls.

..... m [2]

(b) **(i)** Water flows over the Browne Falls at a rate of 3680 litres per second.
After rain, this rate increases to 9752 litres per second.

Calculate the percentage increase in this rate.

..... % [3]

(ii) After rain, water flows over the Sutherland Falls at a rate of 74 240 litres per second.
This is an increase of 45% on the rate before the rain.

Calculate the rate before the rain.

..... litres/second [3]

MARKING SCHEME:

(a)(i)	1200	**2**	**M1** for $1962 \div 1.635$
(a)(ii)	1667.7[0] final answer	**2**	**M1** for $1962 \times (1 - \frac{15}{100})$ oe or **B1** for 294.3[0] If 0 scored, **SC1** for answer 1020
(a)(iii)	275	**2**	**M1** for $220 \div$ *their* $(5 - 1)$ soi
b(i)	165	**3**	**M2** for $\frac{9752 - 3680}{3680}[\times 100]$ oe or $\frac{9752}{3680} \times 100$ oe or **M1** for $\frac{9752}{3680}$ or $9752 - 3680$
b(ii)	51 200	**3**	**M2** for $\frac{74240}{100 + 45}[\times 100]$ oe or **M1** for 74 240 associated with 145[%] oe

4 **(a)** A school has 240 students.
The ratio girls : boys = 25 : 23.

(i) Show that the number of boys is 115.

[1]

(ii) One day, there are 15 girls absent and 15 boys absent.

Find the ratio girls : boys in school on this day.
Give your answer in its simplest form.

..... : ..... [2]

(iii) Next year, the number of students will increase by 15%.

Calculate the number of students next year.

..... [2]

(iv) Since the school was opened, the number of students has increased by 60%.
There are now 240 students.

Calculate the number of students when the school was opened.

..... [3]

(b) The population of a city is increasing exponentially at a rate of 2% each year.
The population now is 256 000.

Calculate the population after 30 years.
Give your answer correct to the nearest thousand.

..... [3]

(c) A bacteria population increases exponentially at a rate of r% each day.
After 32 days, the population has increased by 309%.

Find the value of r.

r = ... [3]

MARKING SCHEMEl

(a)(i)	$\frac{240}{(23+25)} \times 23$	**M1**	
(a)(ii)	11 : 10	**2**	**M1** for 110 : 100 or better or **SC1** for 10 : 11, following boys 100, girls 110
(a)(iii)	276	**2**	**M1** for $240 \times \left(1+\frac{15}{100}\right)$ oe or **B1** for 36 seen
(a)(iv)	150	**3**	**M2** for $\frac{240}{100+60}$ [× 100] oe or **M1** for evidence of 160[%] associated 240
(b)	464 000	**3**	**M1** for $256\,000 \times \left(1+\frac{2}{100}\right)^{30}$ oe **A1** for 463 700 to 463 710 **B1** for *their* more accurate answer seen and rounded to nearest 1000
(c)	4.5[0]	**3**	**M2** for $[x =] \sqrt[32]{4.09}$ oe or **M1** for $(x)^{32} = 4.09$ oe If 0 scored, **SC2** for answer 3.6 or 3.59 or 3.588… or **SC1** for $\sqrt[32]{3.09}$ or 1.0358 to 1.036 seen

5 **(a)** Ali and Mo share a sum of money in the ratio Ali : Mo = 9 : 7.
Ali receives $600 more than Mo.

Calculate how much each receives.

Ali $ .....

Mo $ ..... [3]

(b) In a sale, Ali buys a television for $195.80 .
The original price was $220.

Calculate the percentage reduction on the original price.

..... % [3]

(c) In the sale, Mo buys a jacket for $63.
The original price was reduced by 25%.

Calculate the original price of the jacket.

$ ..... [3]

MARKING SCHEME:

(a)	[Ali] 2700 [Mo] 2100	**3**	**B2** for one correct or for correct values reversed or **M1** for $600 \div (9 - 7)$ or for any equation that would lead to an answer of 300, 2700 or 2100, or 4800 (for the total)
(b)	11	**3**	**M2** for $\frac{220 - 195.8}{220}[\times 100]$ or for $[100 -]\frac{195.8}{220} \times 100$ or **M1** for $220 - 195.8$ or for $\frac{195.8}{220}$ or a correct implicit equation for percentage reduction or for $\frac{195.8 - 220}{220}$
(c)	84	**3**	**M2** for $\frac{63}{1 - \frac{25}{100}}$ oe or **M1** for associating 63 with (100 – 25)% or a correct implicit equation for the original price.