OCR
Oxford Cambridge and RSA

Level 3 Certificate

Quantitative Problem Solving (MEI)

Unit **H867/01** Introduction to quantitative reasoning

OCR Level 3 Certificate

Mark Schemes for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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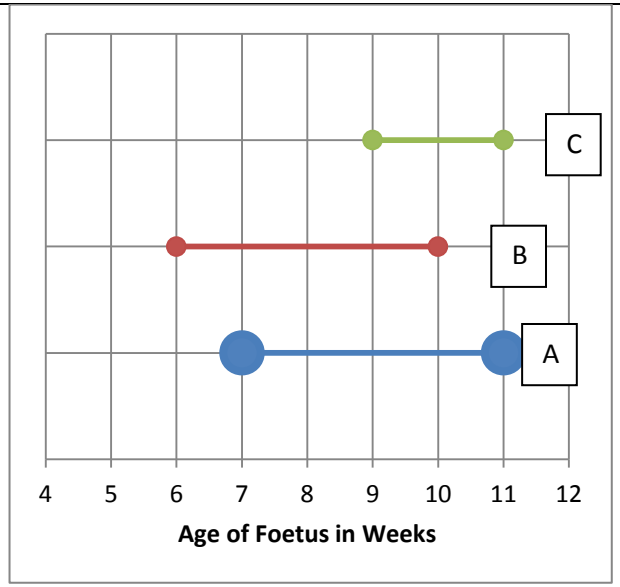
MARK SCHEME: FORMAT 1

Question			Answer	Marks	Guidance
1	i		$\frac{12.6+13.1+12.5+12.8+13.0}{5}\left(=\frac{64}{5}\right)=12.8(s)$	B1 **[1]**	
1	ii		$\frac{10}{12.8}=0.78(125)$ (litres/sec)	(M1) A1 **[2]**	Full follow through from part (i) Not 0.8 or 0.7
1	iii		$0.78(125)=\frac{6000}{t}$ or $0.78(125)t=6000$ $t=\frac{6000}{0.78(125)}=7680$(s) or 7692(s) $\frac{"7680"}{3600}(=2.133\ldots)$ $\approx$ 2 hours	(M1) M1 (A1) M1 B1ft **[5]**	Substitute correct numbers (FT from (ii)) rearrange correctly (with their numbers) art 7700, can be implied Allow the alternative approach, not using the estimate, but using 10 litres $\rightarrow$ 12.8 s so 600 x (10 litres) takes 600 x (12.8 a) = 7680 division by 3600, possibly in stages. If no working SC1 for answer of 2 hours Allow equivalent, non-algebraic approaches.

2	i		e.g. pizza is same shape (or circular) or depth is the same for both pizzas. or same type/specification/quality	E1 [1]	Any relevant assumption
2	ii		Many students will (implicitly) assume a circular pizza: $4.5^2\pi(= 63.6),\ 12^2\pi(= 113.1)$ Medium pizza: $10 \div 63.6 = 0.157$ (£/sq in) or $\frac{63.6}{10} =$ 6.36 (sq in/£) Large pizza: $14 \div 113.1 = 0.124$ (£/sq in) or $\frac{12^2\pi}{14} = 8.08$ (sq in / £) The large pizza is better value. Alternative if using diameter in place of radius: $9^2\pi(= 254.5),\ 12^2\pi(= 452.4)$ Medium pizza: $10 \div 254.5 = 0.039$ (£/sq in) or $\frac{254.5}{10} =$ 25.4 (sq in/£) Large pizza: $14 \div 452.4 = 0.031$ (£/sq in) or $\frac{12^2\pi}{14} = 32.3$ (sq in / £) The large pizza is better value.	 M1 M1 A1 B1 ft M0 M1 M1 B1 ft	 Attempt at an area calculation Attempt two consistent divisions Both numbers correct may be rounded to 2sf. Answer consistent with the calculation Can be gained if “per inch” used providing supported by consistent “wrong” working.

			Alternatively, an approach using scale factors is possible (and indeed preferable!): Price scale factor is $14 \div 10 = 1.4$ (or 0.714 ...) Area scale factor is $12^2 \div 9^2 \approx 1.78$ (0.562 ...) The larger pizza is better value.	M1 M1 A1 B1ft **[4]**	(1.16(666 ...) and 1.11(...)) Attempting "price ratio" For area comparison Also accept any answer which follows on from their assumptions (e.g. if thickness changes in proportion)
3	i			M1 A1 A1 A1 **[4]**	One bar correctly centered 6-10 bar (Condone lack of circles at end or added circles) 9-11 bar (Condone lack of circles at end) All three bars correctly labeled (allow ft from correctly centered lines) If no lines but dots SC1 for each pair of dots (unambiguous) If no lines but dots correct and unambiguously labelled gains SC3

3	ii		Between 9 and 10 weeks.	B1 B1 **[2]**	1 mark for each number. FT from their graph (a possible two marks but need both lines)
4	i		200×96.88 $= 19376$ (rupees)	M1 A1 **[2]**	For choosing the correct "sell rate" cao
4	ii		$19376 \div 103.46$ $= (£)187.28$ $\frac{200-"187.28"}{200} \times 100$ $= 6.36(\%)$ *or* $6.4(\%)$ or $6.3599(4\ldots)\%$ or 6% (with working)	M1 A1 M1 A1cao **[4]**	Their value divided by a rate from table. FT Calculation doesn't need $\times 100$ _____ OR ALTERNATIVE METHOD _____ Using the actual exchange rates themselves M1 for $(96.88 \div 103.46)$ A1 $= 0.9364$ ..... M1 for (1 - 0.9364 .....) oe _____ Ignore extraneous minus signs.

4	iii		(US:) $(55 + 8) \div 1.46$ or (US:) $55 \div 1.46$ $\approx$ (£)43. (15) The UK deal is cheaper	M1 A1 B1ft [3]	Accept alternative method converting £ to $. (No credit for "55") Conclusion consistent with their calculations. Full working (not necessarily correct) must be seen.
4	iv		e.g consider buying something for say 100 EUR (need least £) Bank: $\frac{"100"}{1.31}$ = (£)76.34 oe Credit card: $\frac{("100" \times 1.03)}{1.34}$ = ((£)76.87) The bank provides better value. **Alternative Methods:** [1]Credit card rate is equivalent to $\frac{1.34}{1.03} = 1.30$ So bank provides better value.	 M1 M1 A1 B1ft [4] M1A1 A1 A1 [4]	Method converting £ to € (see below) Dividing by appropriate rate. Can be implied. *Their* amount (not necessarily explicitly stated) ÷1.31 Consistent with their "100" Answer consistent with calculations. Full working must be seen. (Full working must include account taken of commission but not necessarily correct) _____ OR ALTERNATIVE METHODS _____ Fraction Answer

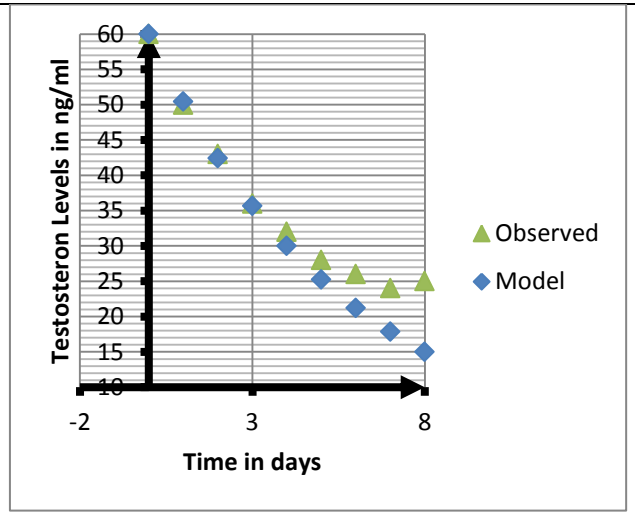
			[2] Method involving starting from a sum of money in sterling say (£100) (so best is most €) Bank: "£100" x 131 = (€)"131" Credit card: $\frac{("100"\times 1.34)}{1.03}$ = (€) "1.30(0097)"	—— M1 M1 A1 B1(ft) **[4]**	From correct method but if M0 SC1 for ("100" × 1.34) × 0.97 = 129.(98) i.e. effectively awarding correct answer to a partially correct method. Answer consistent with calculations., working must be seen. (Working must include account taken of commission but not necessarily correct)
5	i		60 miles = (60 ÷ 5) × 8000 = 96000m 60 mph = $\frac{"96000"}{3600}$ = 26.7 or 27 or 26.67 or 26.6(recurring)(ms^{-1})	M1 M1 A1 **[3]**	Any relevant to conversion from Imperial into metric. (e.g. 60 mph to 96 kph) FT from error in conversion (most likely km to m) CAO

5	ii		$\frac{26.7}{3.2}$ $= 8.3\ (\text{m}s^{-2})$ Yes, it is safe.	M1 A1 B1 (dep) **[3]**	Full follow through from part (i) FT based on their calculation
5	iii		Tangent around 0.05s or triangle somewhere in the region 0.04 to 0.075 change in y change in x $\frac{\textit{their}\text{ change in y}}{\textit{their}\text{ change in x}}$ $(-)500$ to 600 (m/s^2) not safe	B1 M1 M1 M1 A1 B1 **[6]**	 from their triangle Based on *their* stated figures. CAO consistent with their numerical answer
6	i		Underestimate. Some head injuries may go unreported or be reported somewhere other than the emergency room.	B1 B1 **[2]**	

6	ii		American football: $\frac{46\,948}{18300000} = 0.0025(65\ldots)$ oe winter sports: $\frac{16\,948}{10\,800\,000} = 0.0015(69\ldots)$ oe cycling: $\frac{85\,389}{46\,800\,000} = 0.0018(24\ldots)$ .oe Football has the largest number of admissions per participant or it is the least safe oe	M1 A1 A1 [3]	At least one correct calculation attempted (allow working in millions, %) Allow rot to 2sf or more At least two correct All the numbers and conclusion correct Condone responses given as unit fractions, e.g $\frac{1}{390}$ (see below) – but not 1 in 390 or 1:390 _____ **For inverse of the rates** _____ (Effectively condoning the mis-read of "rate of accidents" as "what's the least safe sport") Full credit for 1 in 390 or 389 and 1 in 637 and 1 in 548 iff correct units attached e.g. "1 in X participants received head injuries with American football" oe as the most dangerous oe _____ SC2 for all inverses correct :-1 in 390 or 389 / 1 in 637 / 1 in 548 or 398.79 ... / 637.24 ... / 548.07 ... (rot to 2 sf etc. as with the correct "non-inverse")and "America football" as the largest relative number of admission or most dangerous. or SC1 for at least two inverse rates correct (to the above accuracy

6	iii		• Severity of injuries / fatalities • Whether there are other types of injuries • How often the participants do the activity • Whether injuries are equally spread across participants. • Data about other sports (e.g. boxing.) • Data over several years	B1 B1 **[2]**	one mark per relevant answer

7	i		<table><tr><th></th><th>A</th><th>B</th></tr><tr><td>1</td><td>t</td><td>C</td></tr><tr><td>2</td><td>0</td><td>60</td></tr><tr><td>3</td><td>1</td><td>50.45</td></tr><tr><td>4</td><td>2</td><td>42.43</td></tr><tr><td>5</td><td>3</td><td>35.68</td></tr><tr><td>6</td><td>4</td><td>30.00 or 30</td></tr><tr><td>7</td><td>5</td><td>25.23</td></tr><tr><td>8</td><td>6</td><td>21.21</td></tr><tr><td>9</td><td>7</td><td>17.84</td></tr><tr><td>10</td><td>8</td><td>15.00</td></tr></table>	B1 B1 **[2]**	any one correct all correct
7	ii		=60*0.5^(0.25*A3) or =$B$2*0.5^(0.25*A3) =60*0.5^(0.25*A3) or =$B$2*0.5^(0.25*A3) = 60*0.5^(0.25*A3) or =$B$2*0.5^(0.25*A3)	B1 B1 B1 **[3]**	(note cell references can be absolute or relative)

7	iii		4 (days)	B1 ft [1]	from their spreadsheet; units not required
7	iv		Day 7	M1 A1ft [2]	Any attempt to solve equation or making clear that they are looking for value of 20 (or less) in table. (e.g. 17.48 – **using** reading rather than day or cell 9)
7	v			A1 A1 [2]	At least 3 points plotted correctly. All points plotted correctly (±0.5 division). If not clear whether first three days (4 points) are plotted award this mark if correct points plotted for all the other 5 days (see overlay)
7	vi		It starts off a good model or gets worse oe	B1	Must relate to the model (each one implies the other) "shows the same trend" oe gains no credit – the observed is levelling out the model is tending to zero.

8	i		The points lie on **the** straight line	B1 **[1]**	Mention of "line of best fit" , "**a** straight line" or "correlation" not allowed. The line existed before the points were plotted.
8	ii		$59.0 \pm 2 \times 9.9$ 39.2 to 78.8 (cm)	M1 M1 A1 **[3]**	Any interval centered on 59. (49.1 – 68.9 common, also average of two stated ends = 59) 2×9.9 or 19.8 allow 39 to 79
8	iii	A	Tree diagram or use of formula 0.95×0.95 or 95×0.95 0.9(025) or 90%	M1 M1 A1 **[3]**	at least the relevant branches correctly numerically labeled (may be implied) Accept equivalent.
8	Iii	B	Girls are (statistically) independent oe	B1 **[1]**	
8	iv		0.95 or 95%	B1 **[1]**	
8	v		There will be more needed closer to the middle of the range or Non-uniform (distribution) oe. Less small and large girls	B1 **[1]**	Beware repeating the question as an answer. Absolute minimum of "more girls of certain sizes". Focus should be on customer sizes not their preferences.

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