revise.wales - Mark Scheme

Mock Paper B - Unit 1: Financial Mathematics and Other Applications of Numeracy (Higher Tier, Calculator-allowed)

80 marks. R.WM-MNH-U1-002 (MS).

Notation. Mn = method mark; An = accuracy / answer mark; Bn = independent unsupported correct value; Cn = communication (OCW); ft = follow through from a prior error; oe = or equivalent; cao = correct answer only.

Question 1 (5 marks)

(a) **B1** HCF $= 2 \times 3 \times 7 =$ **42** (cao).

(b) **B1** $\frac{3}{4} \times 0{\cdot}64 \times 712{\cdot}50 = 0{\cdot}48 \times 712{\cdot}50 =$ £**342·00** (cao).

(c) **M1** Morning used $= 840 \times \frac{2}{5} = 336$; remaining $= 840 - 336 = 504$ L.

M1 Afternoon used $= 0{\cdot}45 \times 504 = 226{\cdot}8$ L.

A1 Water left $= 504 - 226{\cdot}8 =$ **277·2** litres (cao).

Question 2 (8 marks)

(a) **M1** Card fee $= 0{\cdot}016 \times 4260 =$ £$68{\cdot}16$.

M1 Total costs $= 1278 + 615 + 980 + 68{\cdot}16 =$ £$2{,}941{\cdot}16$.

M1 Profit $= 4260 - 2941{\cdot}16 =$ £$1{,}318{\cdot}84$.

A1 Margin $= \dfrac{1318{\cdot}84}{4260} \times 100 = 30{\cdot}958\ldots \approx$ **31·0**% (cao; accept $30{\cdot}9$–$31{\cdot}0$%).

(b) **(i)** **B1** $9000/250 =$ **36** whole weeks (cao).

(ii) **B1** Yes – weekly profit from (a) is approximately £$1{,}319$, so saving £250 per week is well within reach (oe; any sensible comparison $250 < 1319$).

(iii) **M1** Discounted price $= 0{\cdot}95 \times 9000 =$ £$8{,}550$; instalment total $= 12 \times 770 =$ £$9{,}240$.

A1 Additional cost $= 9240 - 8550 =$ £**690·00** (cao).

Question 3 (4 marks)

(a) **M1** $145 \times 0{\cdot}75 \times 0{\cdot}90$ (apply 25% reduction then 10% on reduced).

A1 $=$ £**97·88** (accept exact value £$97{\cdot}875$; answers to nearest penny).

(b) **M1** Single 35%: $145 \times 0{\cdot}65 =$ £$94{\cdot}25$; difference $= 97{\cdot}875 - 94{\cdot}25 =$ £$3{\cdot}625 = 362{\cdot}5$ pence.

A1 Difference $\approx$ **363** pence (or £$3{\cdot}63$); the single 35% discount is cheaper. Must state which is cheaper.

Question 4 (10 marks)

(a) **M1** Apply commission: $600 \times 0{\cdot}975 =$ £585.

M1 Convert to yen at sell rate: $585 \times 185 =$ ¥$108{,}225$; after spending ¥$80{,}000$, remaining

$= ¥\,28{,}225$.

M1 Convert back at buy-back rate: $28{,}225/192$.

A1 $=$ £ **147·01** (± 1 p tolerance; exact £$\,147{\cdot}005\ldots$).

(b) **M1** Pre-DST leg $23{:}50 \to 01{:}00$ on Sunday $= 1$ h 10 min.

M1 After clocks jump to $02{:}00$ BST, Japan is now BST $+ 8$ h, so Tokyo $19{:}25$ local $= 11{:}25$ BST. Post-DST leg $02{:}00 \to 11{:}25 = 9$ h 25 min.

A1 Total $= 1$ h 10 min $+ 9$ h 25 min $=$ **10** h **35** min (cao).

Alt: convert both endpoints to UTC. Departure $= 23{:}50$ UTC Sat; landing $= 19{:}25$ Tokyo $= 10{:}25$ UTC Sun; elapsed $= 10$ h 35 min. Candidate must show at least one compensating step (BST forward, Japan unchanged) for both M1s.

(c) **M1** Value of $¥\,80{,}000$ at sell rate (the rate at which the yen was bought) $= 80{,}000/185 =$ £$\,432{\cdot}43$. Loss $= 600 - 147{\cdot}01 - 432{\cdot}43 =$ £$\,20{\cdot}56$.

A1 Percentage loss $= 20{\cdot}56/600 \times 100 \approx$ **3·4**% (accept $3{\cdot}4$–$3{\cdot}5$%).

A1 Comment: friend is partly right – there *is* a loss (commission plus the buy/sell spread) – but it is not avoidable for the spending Iwan actually did in Japan, so calling it "always loses money" is unfair (oe; accept any sensible engagement with the spread or with the spending constraint).

Question 5 (11 marks)

(a) **M1** Valley: $\left(1 + \frac{0{\cdot}048}{4}\right)^4 - 1$.

A1 AER $=$ **4·887**% (accept $4{\cdot}886$–$4{\cdot}888$%).

M1 Coastal: $\left(1 + \frac{0{\cdot}0475}{12}\right)^{12} - 1$.

A1 AER $=$ **4·854**% (accept $4{\cdot}853$–$4{\cdot}855$%); choose *Valley Bank*.

(b) **M1** C: $5000 \times (1 + 3 \times 0{\cdot}055) =$ £$\,5{,}825{\cdot}00$.

M1 D: $5000 \times 1{\cdot}045^3 =$ £$\,5{,}705{\cdot}83$.

A1 State $5825 > 5705{\cdot}83$; C is larger. Both values required.

(c) **M1** Test successive years. At $n = 9$: C $=$ £$\,7{,}475$, D $= 5000 \times 1{\cdot}045^9 =$ £$\,7{,}430{\cdot}51$. At $n = 10$: C $=$ £$\,7{,}750$, D $= 5000 \times 1{\cdot}045^{10} =$ £$\,7{,}764{\cdot}83$.

A1 Year **10** – D first overtakes C (cao).

(d) **M1** Compute $1{\cdot}045^{16}$ via repeated squaring (or direct): $1{\cdot}045^2 = 1{\cdot}092025$; square: $^4 = 1{\cdot}192519$; square: $^8 = 1{\cdot}422101$; square: $^{16} = 2{\cdot}022370$.

A1 $1{\cdot}045^{16} \approx 2{\cdot}0224 > 2$; hence the balance $5000 \times 1{\cdot}045^{16} \approx$ £$\,10{,}111{\cdot}85 >$ £$\,10{,}000$, so D more than doubles within 16 years (oe). Reject answers that merely cite the rule-of-72 shortcut.

Question 6 (10 (incl. 2 OCW) marks)

(a) *Total profit – with OCW.* **M1** Identify Branwen's ratio share as $\frac{5}{6+5+4+3} = \frac{5}{18}$ of total profit T.

M1 Recognise £$\,348 = 80$% of Branwen's share (reverse the 20% donation; do *not* add 20%).

A1 Branwen's share $= 348/0{\cdot}80 =$ £$\,435{\cdot}00$.

M1 $\frac{5}{18}T = 435 \Rightarrow T = 435 \times \frac{18}{5}$.

A1 $T =$ £ **1,566·00** (cao).

A1 Concluding sentence with units (e.g. "The total profit for the year was £$\,1{,}566$").

C1 (OCW) Working in connected sentences; explicit fraction statement; clear reversal of the 20% reduction; concluding sentence.

C1 (OCW) Correct notation throughout (pound signs, aligned equals, no spelling errors obscuring meaning).

(b) **M1** Dafydd $= \frac{3}{18} \times 1566$ (ft).

A1 $=$ £**261·00** (cao).

Question 7 (10 marks)

(a) **B1** Cardiff-only sample is biased: it would over-represent Cardiff members and miss any differences between branches in opinion.

B1 A stratified sample reflects the membership split across all four branches in proportion, so generalises better to the whole chain (oe).

(b) **M1** Total members $= 1800+1200+900+600 = 4500$; proportions of 200: $\frac{1800}{4500}, \frac{1200}{4500}, \frac{900}{4500}, \frac{600}{4500}$ of 200.

A1 Cardiff $= 80$, Newport $= 53{\cdot}33\ldots \to$ **53**, Bridgend $=$ **40**, Aberystwyth $= 26{\cdot}67\ldots \to$ **27**; sum $= 200$ (must sum exactly to 200; accept any sensible rounding that totals 200).

(c) *Two-way table completion.* **M1** Male strength $= 92 - 35 - 15 = 42$; hence female strength $= 60 - 42 = 18$.

M1 Female total $= 200 - 92 = 108$; check $46 + 18 + 44 = 108$ (consistent).

M1 Cardio total $= 35 + 46 = 81$; yoga total $= 15 + 44 = 59$; check $81 + 60 + 59 = 200$.

A1 All five missing cells correct: Male strength **42**, Female strength **18**, Female total **108**, Cardio total **81**, Yoga total **59** (cao).

(d) **M1** $P(\text{strength} \mid \text{male}) = \dfrac{\text{Male strength}}{\text{Male total}} = \dfrac{42}{92}$.

A1 $= \dfrac{\mathbf{21}}{\mathbf{46}}$ (simplified; gcd$(42, 92) = 2$).

Question 8 (11 marks)

(a) **M1** $E = kmv^2$ (joint-proportion form).

M1 Sub $m = 4, v = 3, E = 18$: $18 = k \times 4 \times 9 = 36k \Rightarrow k = \frac{1}{2}$.

A1 $\mathbf{E = \frac{1}{2}mv^2}$ (cao; oe $E = mv^2/2$).

(b) **M1** Sub $m = 6, v = 5$: $E = \frac{1}{2} \times 6 \times 25$.

A1 $\mathbf{E = 75}$ J (cao).

(c) **B1** Length: $1{\cdot}55 \le L < 1{\cdot}65$ m; width: $0{\cdot}825 \le W < 0{\cdot}875$ m; depth: $0{\cdot}55 \le D < 0{\cdot}65$ m (at least two correct).

B1 Density: $997{\cdot}5 \le \rho < 1002{\cdot}5$ kg/m^3 (all four bounds correct for full B1 ·2).

(d) **M1** UB volume $= 1{\cdot}65 \times 0{\cdot}875 \times 0{\cdot}65 = 0{\cdot}93844$ m^3; UB density $= 1002{\cdot}5$.

A1 UB mass $= 0{\cdot}93844 \times 1002{\cdot}5 = 940{\cdot}78\ldots \approx$ **941** kg (cao; accept 940–941 kg).

(e) **M1** LB mass $= 1{\cdot}55 \times 0{\cdot}825 \times 0{\cdot}55 \times 997{\cdot}5 = 0{\cdot}70331 \times 997{\cdot}5 \approx 701{\cdot}55$ kg; compare to UB ≈ 941 kg.

A1 Both bounds agree only when rounded to the nearest 1000 kg (since 701 and 941 both round to 1000); to nearest 100 kg they give 700 and 900, which disagree. Reliable answer is therefore **1000** kg to the nearest 1000 kg (oe; must justify with the comparison).

Question 9 (11 marks)

(a) **M1** Area under speed-time graph: triangle + rectangle + triangle.

M1 $= \frac{1}{2} \times 12 \times 18 + 40 \times 18 + \frac{1}{2} \times 8 \times 18 = 108 + 720 + 72$.

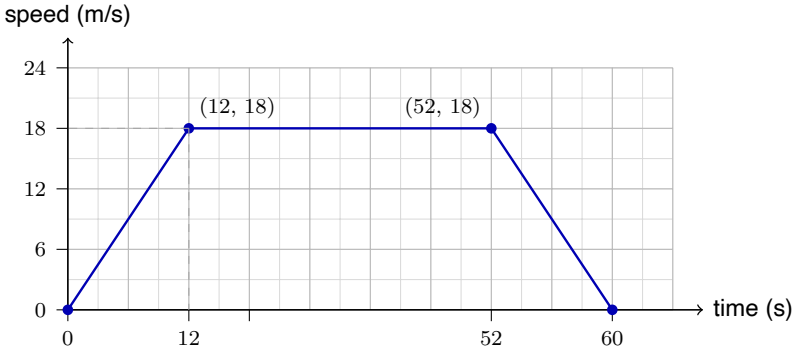
A1 Total distance $=$ **900** m (cao).

(b) **M1** Total time $= 12 + 40 + 8 = 60$ s; convert 900 m $= 0{\cdot}9$ km and 60 s $= \frac{1}{60}$ h.

M1 Average speed $= 0{\cdot}9 \div \frac{1}{60}$.

A1 $=$ **54** km/h (cao; alt: 15 m/s $\times\ 3{\cdot}6 = 54$ km/h).

(c)



B1 Rising segment $(0, 0) \rightarrow (12, 18)$ and horizontal segment to $(52, 18)$ drawn with axes labelled.

B1 Decelerating segment $(52, 18) \rightarrow (60, 0)$; the speed 18 m/s and key times $(12, 52, 60)$ labelled.

(d) **M1** Initial: $7x + 4x = 11x = 165 \Rightarrow x = 15$; apples $= 105$, pears $= 60$. After: apples $= 105 - 21 = 84$, pears $= 60 + p$.

M1 Apply ratio $2 : 3$: $\dfrac{84}{60 + p} = \dfrac{2}{3} \Rightarrow 252 = 2(60 + p) = 120 + 2p$.

A1 Pears delivered $= p = \dfrac{252 - 120}{2} =$ **66** (cao).

Total: $5 + 8 + 4 + 10 + 11 + 10 + 10 + 11 + 11 =$ **80 marks.**

OCW marks (Q6): the 2 OCW marks are included in the question total of 10. To award full OCW the candidate's working must read as connected English sentences.