Mark Scheme (Results)

October 2020

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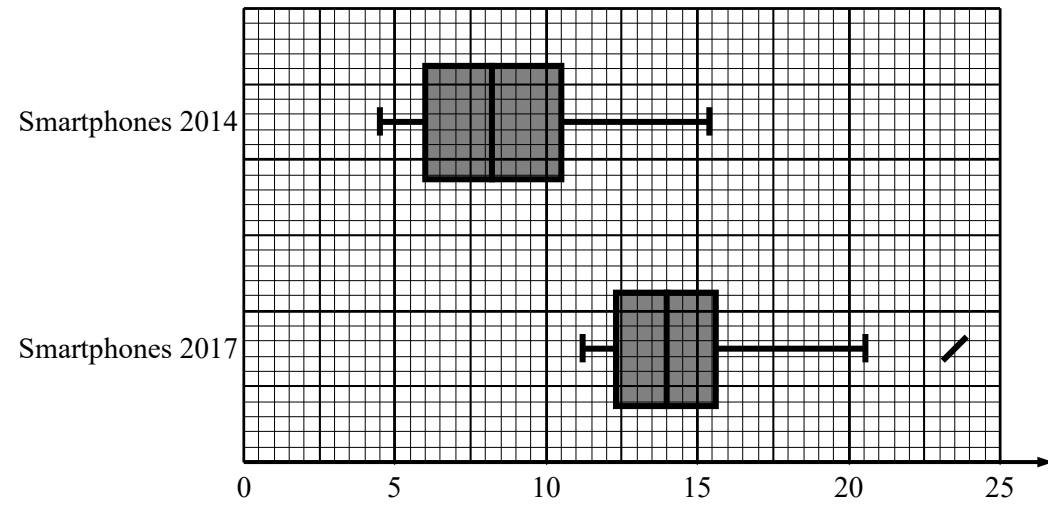
General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
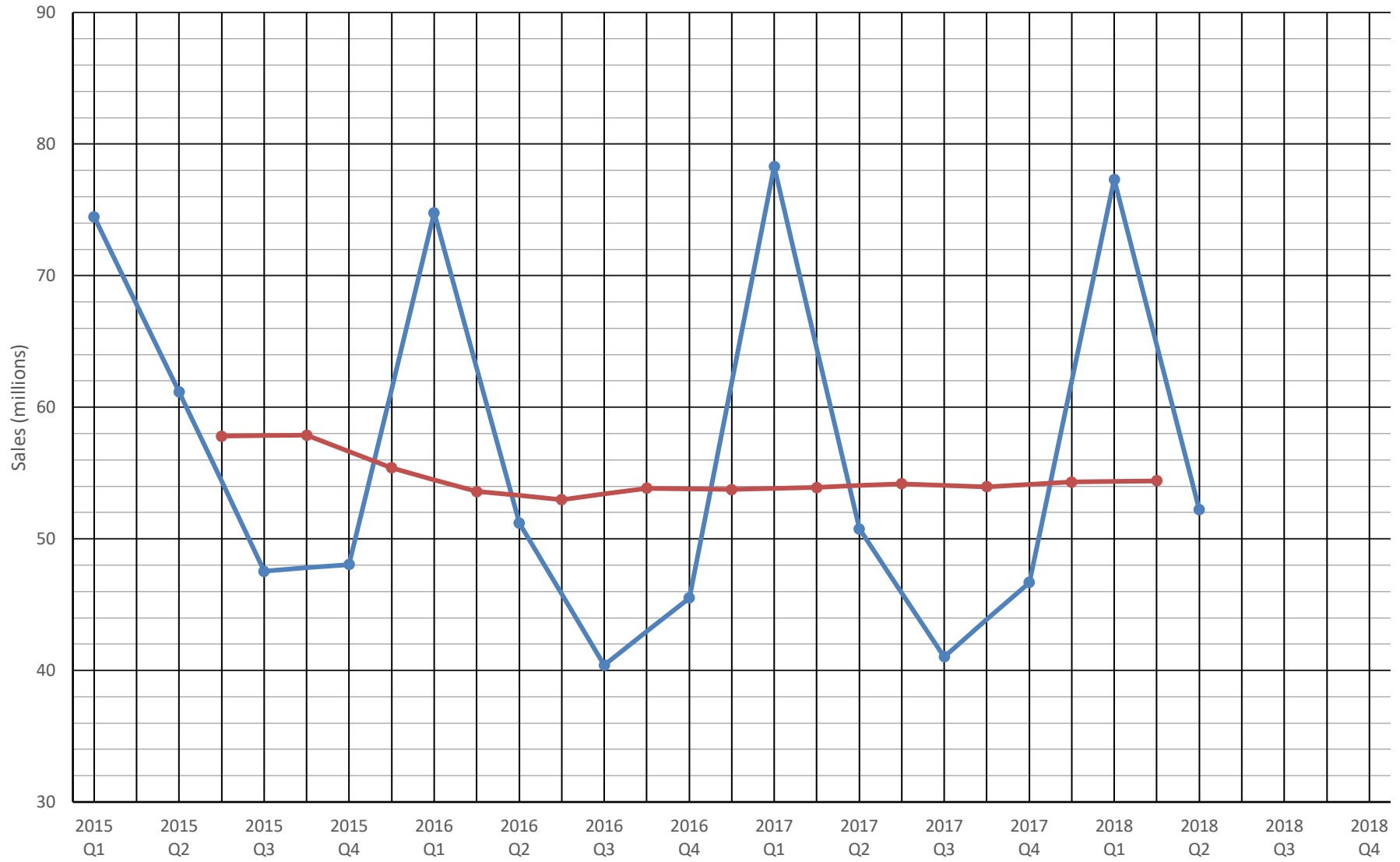
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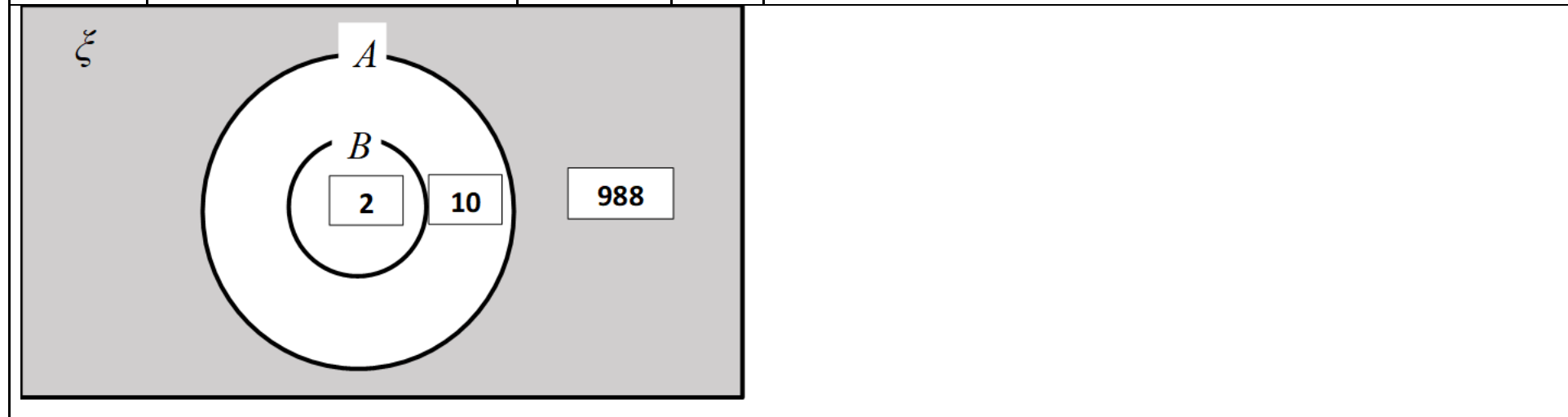| Question	Working	Answer	Mark	Notes
1(a)	IQR = 15.6 – 12.3 = 3.3 15.6 + 1.5 × 3.3 = 20.55 (UB) 12.3 – 1.5 × 3.3 = 7.35 (LB)	Box plot drawn	6	B1 for correctly identifying the median.14.0 (LG Leon) may be seen on diagram B1 for correctly identifying either the LQ (LG X Screen 12.3) or UQ (Google Pixel XL 15.6) may be seen on diagram M1 for full method to calculate boundary1.5 × ('15.6 – 12.3') A1 for identification of outlier as Motorola Moto Z Play 23.5 (can be on box plot) B2 ft for a fully correct box plot drawn (B1 for a partially correct box plot, must plot 3 of items correctly (outlier is 1 item)
1(b)		Two comparisons made	2	C2 ft for TWO valid comparisons, at least one in context e.g. battery life of smartphones in 2017 is much greater than the battery life of smartphones in 2014 (C1 ft for one valid comparison/comment eg IQR's are similar Accept valid comment regarding outlier.

Smartphones 2014

Smartphones 2017

0   5   10   15   20   25

Question	Working	Answer	Mark	Notes
2(a)	54.4×4−(46.7+77.3+52.2)	41.4 million	2	M1 54.4×4−(46.7+77.3+52.2) A1 41.4 million o.e.
2(b)		Points correctly plotted	2	B2 All points plotted correctly. (B1ft At least 5 of their points plotted correctly.)
2(c)	Line of best fit or attempt to work out equation of line	210-220 million	2	M1 ft from the graph. Evidence of use of graph for 2018 **OR** finding final value for 2018. A1 Answers in the range 210-220 million
2(d)(i)	<table><tr><td>f</td><td>S</td><td>fS</td></tr><tr><td>7</td><td>12.5</td><td>87.5</td></tr><tr><td>5</td><td>27.5</td><td>137.5</td></tr><tr><td>8</td><td>40</td><td>320</td></tr><tr><td>8</td><td>50</td><td>400</td></tr><tr><td>4</td><td>67.5</td><td>270</td></tr><tr><td>32</td><td></td><td>1215</td></tr></table>	38.0 million	4	M1 for at least 4 products fS consistently within interval (including end points). M1 (dep) for use of at least 3 correct midpoints. M1 (dep on 1st M) for 'ΣfS'÷(7+5+8+8+4) A1 awrt 38.0 million
2(d)(ii)		e.g 152 million	1	B1ft e.g 4דʺ38.0ʺ
2(e)	2(c) with appropriate comment	2(c) with appropriate comment	1	C1ft 2(c) with appropriate comment. e.g. recent trend is around 54 million per quarter but average sales over the period is much lower.

Sales of iPhones 2014 - 2018

Question	Working				Answer	Mark	Notes
3	Genes	Disease Status	Carrier		Correct table	2	B2 All correct (B1 one **complete** row correct)
	FF	positive	**no**				
	FN	**negative**	**yes**				
	NF	**negative**	**yes**				
	NN	**negative**	**no**				
4 (a)					Correct probabilities	2	B2 All probabilities correct (B1 one probability correct)

4 (b)	$\dfrac{1}{25} \times \dfrac{1}{25} \times \dfrac{1}{4} \times 10000$	4	3	M1ft $\dfrac{1}{25} \times "\dfrac{1}{25}"$ OR $0.04 \times "0.04"$ seen
				M1ft $"\dfrac{1}{625}" \times \dfrac{1}{4} \times 10000$
				A1 4
5 (a) (i)		Correct numbers	2	B1 2, 10
				B1ft 988 OR $1000 - 2 - "10"$
5 (a) (ii)		Correct explanation	1	C1 e.g. The disease cannot be present unless the faulty gene is present
5 (a) (iii)		e.g. $A' \cap B'$	1	C1 A' or $A' \cap B'$ or $(A \cup B)'$

5 (b) (i)	$\dfrac{2}{12}$		$\dfrac{1}{6}$	2	M1ft $\dfrac{2}{2 + \text{"}10\text{"}}$ A1 $\dfrac{1}{6}$ o.e.
5 (b) (ii)			1	1	B1 1 cao
6	Manufacture itself = $0.1\times7000+0.6\times4000+0.3\times-3000$ $= 2200$ Go into partnership = $0.1\times4000+0.6\times3000+0.3\times1000$ $= 2500$ With advertising campaign Manufacture itself = $0.2\times7000+0.7\times4000+0.1\times-3000$ $-2000 = 1900$ Go into partnership= $0.2\times4000+0.7\times3000+0.1\times1000-$ $2000 = 1000$ Best course of action is to go into partnership (and not run the advertising campaign)	Go into partnership		6	M1 One correct calculation shown in method for calculating expected value of one option e.g. 0.1×7000 M1 Complete method for Manufacture itself OR Go into partnership A1 Manufacture itself = 2200 OR Go into partnership = 2500 M1 Complete method for advertising campaign and Manufacture itself OR Go into partnership A1 Manufacture itself = 1900 AND Go into partnership = 1000 C1ft Correct choice based on their four calculated values.

Question	Working	Answer	Mark	Notes
7 (a)	9.8×(92-20)	706km 60mm	3	M1 9.8×t (70≤ t≤72) A1 answers in the range 686-706 B1 60mm
7 (b)(i)	280 = 0.0036×480²-5.2×480+c Leading to c=……	1947mm	2	M1 280 = 0.0036×480²-5.2×480+c, leading to c=…… A1 awrt 1950
7 (b)(ii)		1947mm	1	C1ft (dep on M1 in (b)(i)) "1950" awrt
7 (b)(iii)			1	C1 correct statement e.g. "$d^{-4.12}$ is not defined at d=0" or "as d tends to 0, $d^{-4.12}$ tends to infinity" accept "You get 'math error' when d=0"
8	Grade 1: 1111×540=599 940 Grade 2: 9749×20×8.50+9749×540= 6 921 790	$7 521 730	3	M1 1111×540 **or** 9749×540 **or** 5293×4250 **or** 20×8.50 M1 9749×20×8.50 + 9749×540 + 1111×540 A1 ($)7 521 730 Accept method which involves rounding e.g. M1 1000×500 **or** 10000×500 **or** 5000×4000 **or** 20×10 M1 10000×20×10 + 10000×500 + 1000×500 A1 ($)7 500 000
9 (a)	$10^{4.8 + 1.5 \times 7.4}$	7.9×10¹⁵J	2	M1 $10^{4.8 + 1.5 \times 7.4}$ A1 awrt 7.9×10¹⁵(J)
9 (b)	e.g. (7.9(43..)×10¹⁵)÷(63×10¹²) = awfw [125, 126]	Correct calculations plus statement	3	M1 ft 63×10¹² or "7.9(43..)×10¹⁵"÷10¹² M1 ft ("7.9(43..)×10¹⁵")÷(63×10¹²) **or** ("7.9(43..)×10³")÷(63) C1 awrt [125, 126] **AND** "the claim is correct" **OR** M1 ft "7.943×10¹⁵"÷10¹² **or** 63×100 M1 ft "7.943×10¹⁵"÷10¹² **AND** 63×100 C1 7943 **AND** 6300 **AND** "the claim is correct" **OR**

				M1 63×10^{12} M1 $63\times10^{12}\times100$ C1 ft 7.943×10^{15} **AND** 6.3×10^{15} **AND** "the claim is correct"
10 (a)	$\dfrac{1+15+138}{1854}$	$\dfrac{154}{1854}$ o.e.	2	M1 $\dfrac{1+15+138}{1854}$ **OR** $\dfrac{138}{1854}$ A1 $\dfrac{154}{1854}$ **OR** $\dfrac{77}{927}$ **OR** awrt 0.083
10 (b)	$(1-\frac{154}{1854})^{10}=0.420$ $1-0.420=0.58$ 58%	58% and statement	3	M1 ft $1-"\dfrac{154}{1854}"$ M1 ft $(1-"\dfrac{154}{1854}")^{10}$ C1 58% (awrt) and statement or 42% and equivalent statement (Allow the following from part (a) 0.08 will give 0.434, 57% and 43%)

11(a)	$40x + 10y \geq 18000$ to give $4x + y \geq 1800$ $20x + 15 \geq 12000$ to give $4x + 3y \geq 2400$ $20x + 60y \geq 18000$ to give $x + 3y \geq 900$	Correct workings	4	M1 $40x + 10y \geq 18000$ **or** $20x + 15y \geq 12000$ **or** $20x + 60y \geq 18000$ (accept $>$, $<$, $\leq$ or $=$) A1 $40x + 10y \geq 18000$ **or** $20x + 15y \geq 12000$ **or** $20x + 60y \geq 18000$ A1 $40x + 10y \geq 18000$ **AND** $20x + 15y \geq 12000$ **AND** $20x + 60y \geq 18000$ A1 $4x + y \geq 1800$ **AND** $4x + 3y \geq 2400$ **AND** $x + 3y \geq 900$ cao **OR** M1 $0.4x + 0.1y \geq 180$ **or** $0.2x + 0.15y \geq 120$ **or** $0.2x + 0.6y \geq 180$ (accept $>$, $<$, $\leq$ or $=$) A1 $0.4x + 0.1y \geq 180$ **or** $0.2x + 0.15y \geq 120$ **or** $0.2x + 0.6y \geq 180$ A1 $0.4x + 0.1y \geq 180$ **AND** $0.2x + 0.15y \geq 120$ **AND** $0.2x + 0.6y \geq 180$ A1 $4x + y \geq 1800$ **AND** $4x + 3y \geq 2400$ **AND** $x + 3y \geq 900$ cao
11(b)		$x \leq 600$ $y \leq 1000$	2	B1 $x \leq 600$ **OR** $y \leq 1000$ **OR** $x < 600$ **OR** $y < 1000$ B1 $x \leq 600$ **AND** $y \leq 1000$
11(c)	$4x + y = 1800$ $4x + 3y = 2400$ $x + 3y = 900$ $x = 600$ $y = 1000$ drawn correctly Feasible region labelled.	Correctly drawn graph with FR labelled	5	B1 $4x + y = 1800$ drawn correctly B1 $4x + 3y = 2400$ drawn correctly B1 $x + 3y = 900$ drawn correctly B1ft "$x = 600$" **AND** "$y = 1000$" drawn correctly B1 cao Feasible region labelled. (see diagram below)
11(d)		$0.3x + 0.1y$	1	B1 ($C =$) $0.3x + 0.1y$ cao ISW for simplification e.g. $3x + y$ (DON'T accept $0.3px + 0.1py$ etc)
11(e)	Objective line drawn, point found using SEs OR Point testing in FR	$x = 375$ $y = 300$	4	**Objective line:** M1 Objective line drawn with gradient of -3 or -1/3. A1 A correct objective line drawn M1 Method to solve $4x + y = 1800$ and $4x + 3y = 2400$ A1 Optimal point $= (375,300)$ o.e **Point testing:** M1 Attempt to test one vertex in the FR using Objective function. A1ft one vertex of their FR tested correctly with C stated M1 at least two vertices of the correct FR tested correctly

A1optimal point = (375,300)

X	y	cost(p)
200	1000	160
600	100	190
600	1000	280
375	300	142.5
500	133⅓	163.3

Special case: No method shown or method unclear
M1 Correct method to solve
$4x + y = 1800$ and $4x + 3y = 2400$
A1Optimal point = (375, 300)

11(f)	Fibre used: 800−375−300=125g Cost: 3.75×30+3×10+125×0.05	148.75p OR £1.4875	4	M1 800 – "375" – "300" M1 50 ÷ 1000 M1 (dep on previous two M marks) "375"×0.3+"300"×0.1+"125"×0.05 A1 148.75p **OR** £1.4875 (accept 149p oe)