Topical Worksheets for Cambridge O LEVEL

Mathematics D (4024)

Probability (I)

Mark Scheme

1st edition, for examination until 2025

Question	Answer	Marks	AO Element	Notes	Guidance
1(a)	20 [< $t \leqslant$] 25	**1**			
1(b)	25 [< $t \leqslant$] 30	**1**			
1(c)	28.3 or 28.33..	**4**		**M1** for 22.5, 27.5, 32.5, 37.5, 42.5 soi **M1** for Σfx where x is in the correct interval including boundaries **M1**dep for $\Sigma fx \div 120$ or $\Sigma fx \div (44 + 32 + 28 + 12 + 4)$	
1(d)	$\frac{4}{120}$ oe isw	**1**			
2(a)	$\frac{9}{20}$ oe	**1**			
2(b)(i)	**M1** for $\frac{6}{20} \times \frac{5}{19}$ **A1** for $\frac{30}{380}$ oe	**2**			

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2(b)(ii)	$\frac{258}{380}$ oe	**4**		**M3** for $1-\frac{3}{38}-\frac{5}{20}\times\frac{4}{19}-\frac{9}{20}\times\frac{8}{19}$ oe or **M2** for $\frac{3}{38}+\frac{5}{20}\times\frac{4}{19}+\frac{9}{20}\times\frac{8}{19}$ or $\frac{5}{20}\times\frac{9}{19}+\frac{6}{20}\times\frac{9}{19}+\frac{6}{20}\times\frac{5}{19}$ oe or **M1** for for one correct product other than $\frac{6}{20}\times\frac{5}{19}$	
3(a)(i)	$1.5 < h \leqslant 1.6$	**1**			
3(a)(ii)	1.62 or 1.623… nfww	**4**		**M1** for 1.35, 1.45, 1.55, 1.65, 1.75 1.85 soi **M1** for Σfx **M1 dep** for *their* $\Sigma fx \div 120$	
3(b)(i)	$\frac{14}{120}$ oe	**1**			

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3(b)(ii)	$\frac{21}{20060}$ oe	**4**		**M3** for $3\left(\frac{14}{120}\times\frac{7}{119}\times\frac{6}{118}\right)$ or **M2** for $\frac{14}{120}\times\frac{7}{119}\times\frac{6}{118}$ isw or **M1** for $\frac{14}{120}, \frac{7}{119}, \frac{6}{118}$ After 0 scored, **SC1** for answer $\frac{343}{864000}$ or $\frac{343}{288000}$ oe	
3(c)(i)	55, 79, 106, 120	**2**		**B1** for 2 or 3 correct	
3(c)(ii)	Correct diagram	**3**		**B1** for correct horizontal plots **B1FT** for correct vertical plots **B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points If 0 scored **SC1** for 5 out of 6 points correctly plotted	

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3(d)(i)	1.62 to 1.63	**1**			
3(d)(ii)	1.57 to 1.58	**2**		**B1** for 48 soi	
4(a)	$\frac{11}{30}$ oe	**1**			
4(b)	$\frac{25}{30}$ oe	**1**			
4(c)	0	**1**			
5	0	**1**			
6	$\frac{147}{160}$ oe	**3**		**M2** for $\frac{1}{10} \times \frac{3}{4} + \frac{9}{10} \times \frac{15}{16}$ or **M1** for $\frac{1}{10} \times \frac{3}{4}$ or $\frac{9}{10} \times \frac{15}{16}$	
7	$\frac{2}{20}$ oe	**2**		**M1** for $\frac{2}{5} \times \frac{1}{4}$ oe	
8(a)	$\frac{9}{16}$ oe	**2**		**B1** for $\frac{9}{k}$ or $\frac{k}{16}$ provided fraction is less than 1	

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8(b)	46	**1**			
9(a)	$1 - r$	**1**			
9(b)(i)	$(1 - r)(1.3 - r)$ [$= 0.4$]	**1**		**FT** *their* **(a)** dep on **(a)** being an expression in r	
9(b)(ii)	**M1** for $1.3 - 1.3r - r + r^2$ or better nfww **M1** for $0.9 - 2.3r + r^2$ [$= 0$] OR $13 - 13r - 10r + 10r^2 = 4$ oe **A1** for $10r^2 - 23r + 9 = 0$	**3**		**FT** *their* **(b)(i)** **Strict FT** *their* expansion to a quadratic then equating to 0.4 and then collecting to 3 terms on 'one side' OR **Strict FT** *their* expansion to a quadratic = 0.4 all multiplied by 10 no errors or omissions seen	

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9(b)(iii)	**B2** for $(5r - 9)(2r - 1)$ [= 0] **B1** for $[r =] \frac{9}{5}$ oe $\quad [r =] \frac{1}{2}$ oe	**3**		or **B2** for e.g. $5r(2r-1) - 9(2r-1)$ **and then** $5r - 9 = 0$ **and** $2r - 1 = 0$ or **B1** for $5r(2r-1) - 9(2r-1)$[= 0] or $2r(5r-9) - 1(5r-9)$[= 0] or $(5r + a)(2r + b)$ [= 0] where a, b are integers and $ab = +9$ or $2a + 5b = -23$ If 0 scored, **SC1** for $5r - 9$ **and** $2r - 1$ seen but not in factorised form	
9(b)(iv)	0.8 or $\frac{4}{5}$ oe	**1**			

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10	$\frac{1}{6}$ oe	**4**		**M3** for $\frac{5}{9} \times \frac{4}{8} \times \frac{3}{7} + \frac{4}{9} \times \frac{3}{8} \times \frac{2}{7}$ or **M2** for $\frac{5}{9} \times \frac{4}{8} \times \frac{3}{7}$ or $\frac{4}{9} \times \frac{3}{8} \times \frac{2}{7}$ or **M1** for $\frac{5}{9}$, $\frac{4}{8}$, $\frac{3}{7}$ seen or $\frac{4}{9}$, $\frac{3}{8}$, $\frac{2}{7}$ seen If 0 scored, **SC1** for $\frac{5^3 + 4^3}{729}$ oe	
11(a)	$\frac{x-1}{x+2}$	**2**		**B1** for either numerator or denominator correct	

Question	Answer	Marks	AO Element	Notes	Guidance
11(b)(i)	**B1** for $\frac{x}{x+3} \times \frac{x-1}{x+2} = \frac{7}{15}$ **M1** for $15x(x-1) = 7(x+3)(x+2)$ **M1** for $15x^2 - 15x = 7x^2 + 21x + 14x + 42$ **A1** for $[8x^2 - 50x - 42 = 0]$ $4x^2 - 25x - 21 = 0$	**4**		**FT** *their* **(a)(i)** = $\frac{7}{15}$ Removes all algebraic fractions **FT** *their* equation if in comparable form Correctly expands all brackets **FT** *their* equation if in comparable form With no errors or omissions seen and one further stage seen after final M1	
11(b)(ii)	**M2** for $(4x+3)(x-7)[=0]$ **B1** for 7 and $-\frac{3}{4}$	**3**		**M1** for $4x(x-7) + 3(x-7)$ or $x(4x-3) - 7(4x-3)$ or for $(4x+a)(x+b)$ where either $ab = -21$ or $4b + a = -25$ If 0 scored, **SC1** for $4x + 3$ **and** $x - 7$ seen but not in factorised form	

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11(b)(iii)	7	**1**		**FT** *their* positive solution	
12	$\frac{80}{153}$ oe	**3**		**M2** for $2 \times \frac{10}{18} \times \frac{8}{17}$ oe or **M1** for $\frac{10}{18} \times \frac{8}{17}$ oe If 0 scored, **SC1** for $\frac{160}{324}$ oe	
13	$\frac{11}{51}$ oe	**4**		**M3** for $\frac{10}{18} \times \frac{9}{17} \times \frac{8}{16} + \frac{8}{18} \times \frac{7}{17} \times \frac{6}{16}$ oe or **M2** for $\frac{10}{18} \times \frac{9}{17} \times \frac{8}{16}$ oe or $\frac{8}{18} \times \frac{7}{17} \times \frac{6}{16}$ oe or **M1** for $\frac{10}{18}, \frac{9}{17}, \frac{8}{16}$ or $\frac{8}{18}, \frac{7}{17}, \frac{6}{16}$ If 0 scored, **SC1** for $\frac{1512}{5832}$ oe	

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14(a)	111.25	**4**		**M1** for midpoints soi (25, 75, 112.5, 137.5, 175) **M1** for $\sum fx$ with x in correct interval including both boundaries **M1** (dep on 2nd **M1**) for $\sum fx \div 20$	
14(b)	2 7 11 17	**2**		**B1** for three correct	
14(c)	$\frac{3}{20}$ oe	**1**			
15(a)	$\frac{94}{200}$ oe	**2**		**M1** for $\frac{46}{200} + \frac{48}{200}$ oe	
15(b)	14.1 or 14.07…	**3**		**M2** for $2\left(\frac{50}{200} \times \frac{56}{199}\right)$ oe or **M1** for $\frac{50}{200} \times \frac{56}{199}$ oe	
16(a)	14	**1**			
16(b)	16	**1**			

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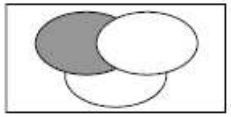
16(c)	$\frac{20}{462}$ oe	**3**		**M2** for $\frac{5}{22} \times \frac{4}{21}$ or **M1** for $\frac{5}{22}$ seen	
16(d)	Correct shading 	**1**			
17(a)	$\frac{3}{5} > \frac{1}{4}$ oe or $\frac{12k}{20k}$ and $\frac{5k}{20k}$ or 0.6 and 0.25 or 60% and 25%	**1**			
17(b)	$\frac{11}{20}$ oe	**3**		**M2** for $\frac{3}{5} \times \frac{3}{4} + \frac{2}{5} \times \frac{1}{4}$ oe or $1 - \frac{3}{5} \times \frac{1}{4} - \frac{2}{5} \times \frac{3}{4}$ oe or **M1** for $\frac{3}{5} \times \frac{3}{4}$ or $\frac{2}{5} \times \frac{1}{4}$ oe (but not as part of a larger product)	

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18	$\frac{11}{25}$ oe	**3**		**M2** for $\frac{3}{5} \times \frac{3}{5} + \frac{2}{5} \times \frac{1}{5}$ oe or $1 - \frac{3}{5} \times \frac{2}{5} - \frac{2}{5} \times \frac{4}{5}$ oe or **M1** for $\frac{3}{5} \times \frac{3}{5}$ or $\frac{2}{5} \times \frac{1}{5}$ or for a correct tree showing all 25 outcomes with the 11 correct outcomes identified	
19(a)(i)	$\frac{10}{20} \times \frac{9}{19}$ oe	**M2**		**B1** for $\frac{9}{19}$ oe seen	

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19(a)(ii)	$\frac{62}{95}$ oe	**4**		**M3** for $\frac{6}{20} \times \frac{14}{19} + \frac{10}{20} \times \frac{10}{19} + \frac{4}{20} \times \frac{16}{19}$ oe or $1 - \frac{6}{20} \times \frac{5}{19} - \frac{10}{20} \times \frac{9}{19} - \frac{4}{20} \times \frac{3}{19}$ oe or **M2** for the sum of two products of different flavours isw or **M1** for one correct product of different flavours isw	

Question	Answer	Marks	AO Element	Notes	Guidance
19(b)	$\frac{5}{57}$ oe	**3**		**M2** for $N \times \left(\frac{4}{20} \times \frac{3}{19} \times \frac{16}{18}\right) + \frac{4}{20} \times \frac{3}{19} \times \frac{2}{18}$ oe or for $3\left(\frac{4}{20} \times \frac{3}{19} \times \frac{16}{18}\right)$ oe or $1-\left\{N \times \left(\frac{4}{20} \times \frac{16}{19} \times \frac{15}{18}\right) + \frac{16}{20} \times \frac{15}{19} \times \frac{14}{18}\right\}$ oe or **M1** for $\frac{4}{20} \times \frac{3}{19} \times \frac{k}{18}$ oe seen	

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20(a)	$\frac{8}{20}$ oe	**3**		**M2** for $\frac{2}{5} \times \frac{1}{4} + \frac{3}{5} \times \frac{2}{4}$ or **M1** for one of these products OR **M1** for probability tree identifying all 20 outcomes with the correct 8 identified OR **M1** for completed possibility space / 2-way table identifying the 8 possible outcomes out of 20, oe **SC1** for $\frac{13}{25}$ with replacement	

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20(b)	$\frac{9}{25}$ oe	**3**		**M2** for $\frac{2}{5} \times \frac{3}{5} + \frac{3}{5} \times \frac{1}{5}$ oe or **M1** for one of these products OR **M1** for probability tree identifying all 25 outcomes with the correct 9 identified OR **M1** for completed possibility space / 2-way table identifying the 9 possible outcomes out of 25, oe	
20(c)	Jojo and e.g. $\frac{40}{100} > \frac{36}{100}$	**1**		**1FT** *their* **(a)** and **(b)** dep on being in range 0 to 1	
					[Total: 115]