Paper 5525/06					
No		**Working**	**Answer**	**Mark**	**Notes**
1	(a)		3.884682778	2	B2 for 3.88468(2…) (B1 for 11.75 or 3.0247 or 3.88(...))
	(b)		3.88	1	B1ft (to 3sf any answers to (a) that have $\geq$ 3sf)
2		$1 \rightarrow 11$ $2 \rightarrow 28$ $1.1 \rightarrow 12.3(31)$ $1.2 \rightarrow 13.7(28)$ $1.3 \rightarrow 15.1(97)$ $1.4 \rightarrow 16.7(44)$ $1.5 \rightarrow 18.3(75)$ $1.6 \rightarrow 20.0(96)$ $1.7 \rightarrow 21.9(13)$ $1.8 \rightarrow 23.8(32)$ $1.9 \rightarrow 25.8(59)$ $1.65 \rightarrow 20.9(92125)$	1.7	4	B2 for trial between 1.6 and 1.7 inclusive (B1 for a trial between 1 and 2 inclusive) B1 for a different trial between 1.6 and 1.7 exclusive B1 (dep. on at least one previous B1) for 1.7 NB trials should be evaluated to at least 1 dp truncated or rounded.
3	(a)	1 share = 210 ÷ 3 (=70) Total = '70' × (3+4+4) =	770	3	M1 for association of 210 with 3 M1 for = (210 ÷ 3) × (3+4+4) oe A1 cao
	(b)	Average speed = 210 ÷ (2hrs 40 mins) $= \frac{210}{2\frac{2}{3}}$ km/h =	78.75	4	M1 uses speed = distance/time M1 (dep) evidence of converting time to a single unit. A1 for 77 to 81 (SC B2 for answer of 87.5) B1 for km/h (or other valid unit if consistent with their value)

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4	(a)		Reason	1	B1 for 'radius is perpendicular to tangent' oe
	(b)	$\tan x = \frac{5.8}{12.5}$ (= 0.464) $P = \tan^{-1}(0.464) = 24.89\ldots$	24.9	3	M1 for $\tan (x =) \frac{5.8}{12.5}$ or $\sin (x =) \frac{5.8}{'OP'}$ or $\cos (x =) \frac{12.5}{'OP'}$ M1 for $\tan^{-1} \frac{5.8}{12.5}$ oe correct use of inverse A1 for 24.9 (or better) (**SC** M1M1A0 for either 0.434(4..) or 27.6(5..) seen)
	(c)	$OP^2 = 12.5^2 + 5.8^2$ $OP = \sqrt{12.5^2 + 5.8^2}\ \left(= \sqrt{189.89}\right) = 13.78\ldots$ $PC = OP - 5.8$	7.98	4	M1 for $12.5^2 + 5.8^2$ M1 for $\sqrt{12.5^2 + 5.8^2}$ OR $\left[\begin{array}{l}\text{M1 for } \cos'24.9' = \frac{12.5}{OP} \text{ or } \sin'24.9' = \frac{5.8}{OP} \\ \text{M1 for } OP = 12.5 \div \cos'24.9 \text{ or } 5.8 \div \sin'24.9'\end{array}\right]$ A1 for 13.7 to 13.8 B1ft (dep on $OP > 12.5$) for adding or subtracting 5.8

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5 (a)	eg $x = -2, y = -2$; $x = 0; y = 3$	Any correct pairs of integers	2	B2 for two correct pairs (B1 for one correct pair)
(b)		(1,1) (1,2) (2,1)	3	B3 for three correct points (B2 for two correct points, B1 for one correct point) **NB** If more than 3 pts marked, mark best three then deduct 1 mark for each additional point SC B2 for indicating the correct region
6	$\frac{CE}{8} = \frac{9}{6}$ or $\frac{CE}{9} = \frac{8}{6} \Rightarrow$ CE $= \frac{8 \times 9}{6}$ $\frac{BC}{13.5} = \frac{6}{9}$ or $\frac{BC}{6} = \frac{13.5}{9} \Rightarrow$ BC $= \frac{13.5 \times 6}{9}$	(i) 12 (ii) 9	3	M1 for scale factor $\frac{9}{6}\left(\text{or } \frac{6}{9}\right)$ or $\frac{8}{6}\left(\text{or } \frac{6}{8}\right)$ or $\frac{13.5}{9}\left(\text{or } \frac{9}{13.5}\right)$ oe A1 cao for 12 A1 cao for 9
7	eg eqn(1) ×4 then subtract eqn(2) ×3 $13y = 65$ or eqn(2) ×7 then subtract eqn(1) ×5 $13x = -39$ eg $4x + 5 \times$ '5' $= 13$	$x = -3$ $y = 5$	4	M1 correct full process to eliminate either x or y (condone one error) A1 cao either $y = 5$ or for $x = -3$ M1 (dep. on 1st M1) for correct substitution of their found value into one of the eqn's A1 cao (both needed)

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8		$x^2 + 4x + 4 = (x + 2)(x + 2)$ $x^2 + 4x + 4 = 0$, so $(x + 2)^2 = 0$, so $x = -2$ is the only value of x that satisfies the equation oe Lisa is correct.	See working column	2	B2 for a complete solution (B1 for verifying that $x = -2$ is a root or for factorising oe)
9	(a)	Increase = 708 – 620 (=88) % increase = $\frac{'88'}{620} \times 100$ = 14.1935…	14 or 14.2 or 14.19	4	M1 for 708 – 620 (=88) M1 for $\frac{'88'}{620} \times 100$ OR $\left[\begin{array}{l}\text{M1 for } \frac{708}{620}\times 100\\ \text{M1 for } '114.19(3...)' - 100\end{array}\right]$ A2 for 14 or 14.2 or 14.19 (A1 for unrounded or truncated answer) (**SC** if A0 award B1 for an answer rounded or given to 2dp, 1dp, 2sf or nearest whole number)
	(b)	$\frac{129.86}{100-14} \times 100 = \frac{12986}{86}$	151	3	M1 for recognizing that (100 – 14)% is equivalent to 129.86 M1 (dep.) for $\frac{129.86}{'100-14'} \times 100$ oe A1 cao
	(c)	$\frac{19+20+15}{3}$	18	2	M1 for adding three consecutive numbers and dividing by 3 A1 cao

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10 (a)	38×5, 36×17.5, 30×32.5, 46×50 (= 190, 630, 975, 2300) $\Sigma fx = 190 + 630 + 975 + 2300 = 4095$ Mean $\Sigma fx / \Sigma f = 4095/150$	27.3	4	M1 for fx with x within intervals (including ends) at least two consistently M1 (dep) for fx consistently using midpoints M1 (dep on 1st M) for use of $\Sigma fx / \Sigma f$ A1 for 27.3 cao
(b)	Frequency density (number of pictures per cm^2) e.g. Width 0 to 10 height of rectangle 3.8(k) Width 10 to 25 height of rectangle 2.4(k) Width 25 to 40 height of rectangle 2(k) Width 40 to 60 height of rectangle 2.3(k)	Bars with correct heights, widths, label and scaling	3	B2 for 4 rectangles with correct widths and heights (B1 for 3 rectangles with correct widths and heights) B1 for correct label or key and consistent scaling (**SC** if 0/3 award M1 if clearly using area or freq. density)
11	Vertices at (–2, –1), (–2, –4), (–3, –1)	See working column	3	B1 for all sides $\times \frac{1}{2}$ B1 for correct orientation with two vertices almost correct B1 cao
12	$5x – 15 = 4y – 3xy$ $5x + 3xy = 4y + 15$ $x(5 + 3y) = 4y + 15$	$x = \frac{4y+15}{5+3y}$	4	M1 for expanding into four terms three of which are correct M1(indep) for rearranging correctly to isolate x terms M1(indep) for factorising x from 2 terms with one factor involving y A1 cao for final answer $x = \frac{4y+15}{5+3y}$ oe

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No		**Working**	**Answer**	**Mark**	**Notes**
13	(a)	$D = kt^2$ $30 = k(40)^2$ $k = 30/1600$ (= 0.01875)	$D = \frac{30}{1600}t^2$	3	M1 for $D = kt^2$ seen or implied $(k \neq 1)$ M1(dep) for substitution or sight of $k = 30/40^2$ oe A1 for $D = \frac{30}{1600}t^2$ oe $k = 0.018(75)$ truncated or rounded
	(b)	$\frac{30}{1600} \times 64^2$	76.8	1	M1 for $'k' \times 64^2$ $(k \neq 1)$ seen
	(c)	$(t^2 =)\ 12 \div (30/1600)$ $t = \sqrt{640} = 25.298...$	25.3	2	M1 for $12 \div 'k'$ $(k \neq 1)$ A1 for 24.4 to 25.9 (ignore –25.3)
14	(a)	'minimum possible diameter is twice minimum possible radius' oe minimum possible diameter = 2 × 14.15 = 28.3cm	See working column	2	M1 for 'minimum possible diameter is twice minimum possible radius' or 2 × 14.15 seen A1 for 28.3 cao
	(b)	**upper bound**, in cm, for radius of outer circle is 15.85 **lower bound**, in cm, for radius of inner circle is 14.15 area, in cm^2, of shaded region = $\pi R^2 - \pi r^2$ $= \pi(15.85)^2 - \pi(14.15)^2$ $= 51\pi$	$k = 51$	4	B1 for 15.85 or 789.2(3…) seen B1 for 14.15 or 629.0(1…) seen M1 for using $\pi R^2 - \pi r^2$ A1 cao (accept final answer left as 51π)

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No	**Working**	**Answer**	**Mark**	**Notes**
15	(1,5) on curve so $pq^1 = 5$ (4,320) on curve so $pq^4 = 320$ $pq^4 = pq\left(q^3\right) = 5q^3 = 320$ so $q^3 = 64$ $q = \sqrt[3]{64} = 4$ and $p = \frac{5}{q} = \frac{5}{4}$	$p = 1.25$ $q = 4$	3	B1 for $pq = 5$ B1 for $pq^4 = 320$ B1 cao for both $p = 1.25$ oe and $q = 4$ (B3 for correct answer with no working)
16 (i)		$2(\mathbf{b} - \mathbf{a})$	3	B1 for $2(\mathbf{b} - \mathbf{a})$ oe
(ii)	$OD = \text{OA} + 4AB = \mathbf{a} + 4(\mathbf{b} - \mathbf{a})$	$4\mathbf{b} - 3\mathbf{a}$		M1 for $OA + 4AB$ or $OA + 2\,'AC'$ oe A1 cao for $4\mathbf{b} - 3\mathbf{a}$
17	$\frac{\cancel{(5+x)}\,(5-x)}{5\,\cancel{(5+x)}}$	$\frac{5-x}{5}$	3	B1 for $(5+x)(5-x)$ B1 for $5(5+x)$ B1 cao for $\frac{5-x}{5}$ oe

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No	Working	Answer	Mark	Notes
18 (a)	$(19x + 28)(x – 8)$	$x = 8$ $x = –28/19$	3	M1 for either $(ax+b)(cx+d)$ with $ac = 19$ and $bd = —224$ or for a clear attempt to use $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with $a = 19$, $b = \pm 124$, $c = \pm 224$ A1 for either $(19x + 28)(x – 8)$ or for $x = \frac{124 \pm \sqrt{32400}}{38}$ A1 for 8 and –28/19 oe (accept –1.47 or better)
(b)	red = n blue = $n + 2$ white = $n + (n+2)$ $n + (n + 2) + [n + (n + 2)] = 4n + 4 = 4(n+1)$*	Proof	1	B1 for $n + (n + 2) + [n + (n + 2)]$
(c)	$\left(\frac{n}{4(n+1)}\right) \times \left(1 - \frac{n}{4(n+1)}\right) = \frac{14}{81}$ $\left(\frac{n}{4(n+1)}\right) \times \left(\frac{3n + 4}{4(n+1)}\right) = \frac{14}{81}$ $81n(3n + 4) = 14 \times 16(n + 1)^2$ $243n^2 + 324n = 224(n^2 + 2n + 1)$ $243n^2 + 324n = 224n^2 + 448n + 224$ $19n^2 – 124n – 224 = 0$*	Proof	5	M1 for multiplying two fractions A1 for $\left(\frac{n}{4(n+1)}\right) \times \left(1 - \frac{n}{4(n+1)}\right)$ oe B1 for correct expansion of $(n + 1)^2$ M1 for a valid method to eliminate fractions from an algebraic expression A1 complete proof

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No	**Working**	**Answer**	**Mark**	**Notes**
(d)	from (a) $n = 8$ so $4(n + 1) = 36$	Proof	1	B1 for substituting n = '8' into $4(n + 1)$ or 8,10,18 seen
(e)	P(different colours) = 1 – [P(RR)+P(BB)+P(WW)] $= 1 - \left[\frac{8}{36}\times\frac{8}{36}+\frac{10}{36}\times\frac{10}{36}+\frac{18}{36}\times\frac{18}{36}\right]$ OR P(different colours) = 2 × [P(RB)+P(RW)+P(BW)] $= 2 \times \left[\frac{8}{36}\times\frac{10}{36}+\frac{8}{36}\times\frac{18}{36}+\frac{10}{36}\times\frac{18}{36}\right]$ OR P(different colours) =P(RR')+P(BB')+P(WW') $= \left[\frac{8}{36}\times\frac{28}{36}+\frac{10}{36}\times\frac{26}{36}+\frac{18}{36}\times\frac{18}{36}\right]$	$\frac{101}{162}$	3	M1 for [P(RR)+P(WW)+P(BB)] or [P(RB)+P(RW)+P(BW)] or [P(RR')+P(BB')+P(WW')] Allow algebraic fractions M1 (dep) for 1 –[P(RR)+P(WW)+P(BB)] or 2×[P(RB)+P(RW)+P(BW)] or P(R)×[1-P(R)]+P(B)×[1-P(B)]+P(W)×[1-P(W)] Numerical values required A1 cao for $\frac{101}{162}$ oe or 0.62(3…) **SC** B2 for $\frac{202}{315}$ oe or 0.65(1…)

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19	(a)	$\frac{29}{\sin 45^o} = \frac{18.4}{\sin \angle PEA}$ $\sin \angle PEA = \frac{18.4 \times \sin 45^o}{29}$ (= 0.4486…) $\angle PEA = 26.6569...$	26.7	3	M1 for correct substitution in sine rule M1 (dep) for rearrangement to get $\frac{18.4 \times \sin 45^o}{29}$ oe (award if 0.448(6…) or 0.538(8…) or 0.412(0…) seen) A1 cao for answers rounding to 26.7
	(b)	$\angle EPF = 2 \times$ [45 + '26.7'] (= 143.4) arc $EF = \frac{143.4}{360} \times \pi \times 58$	72.6	4	M1 for valid method to find $\angle$ EPF (award if 143(.4)^o seen) M2 (dep) for $\frac{'143.4'}{360} \times \pi \times 58$ (M1 for either $\frac{'143.4'}{360} \times k_1$ or for $k_2 \times 58\pi$, where $k_2 < 1$) A1 for 72.5 to 72.6 inclusive **SC** award B2 for 61.1