1	19.3 × 150		2	M1	for 19.3 × 150
		2895		A1	for 2895
					Total 2 marks

2	(a)		$3 < w \leq 4$	1	B1
	(b)	(12 × 2.5) + (16 × 3.5) + (9 × 4.5) + (2 × 5.5) + (1 × 6.5) **or** 30 + 56 + 40.5 + 11 + 6.5 (= 144)		4	M2 for at least **4** correct products added (need not be evaluated) **or** If not M2 then award M1 for consistent use of value within interval (including end points) for at least **4** products which must be added **or** correct midpoints used for at least **4** products and not added
		[(12 × 2.5) + (16 × 3.5) + (9 × 4.5) + (2 × 5.5) + (1 × 6.5)] ÷ 40 **or** '144' ÷ 40			M1 dep on at least M1 Allow division by their Σf provided addition or total under column seen
			3.6		A1 oe
	(c)	$\frac{2}{40}+\frac{1}{40}$		2	M1 for $\frac{a}{40}$ where $0 < a < 40$ or $\frac{3}{b}$ where $b > 3$ where a and b are integers
			$\frac{3}{40}$		A1 0.075 oe
					Total 7 marks

3	1 – (0.24 + 0.31) (= 0.45) Or (0.24 + 0.31) × 180 (= 99)		4	M1	or for a correct equation for missing values eg $x + 0.24 + 2x + 0.31 = 1$ oe (can be implied by 2 probabilities that total 0.45 in table if not contradicted in working space)
	'0.45' ÷ 3 (= 0.15) Or '0.45' × 180 (= 81) Or 180 − 99 (= 81)			M1	(or 0.15 correctly placed in table as long as not contradicted)
	'0.15' × 180 Or '81' ÷ 3			M1	or for an answer of $\frac{27}{180}$
		27		A1	
					Total 4 marks

4	(a)		0.000 78	1	B1
	(b)	22 500 000 oe e.g. 22.5×10^6 **or** 2.25×10^n $n \neq 7$		2	M1
			2.25×10^7		A1
					Total 3 marks

5		$\cos 63 = \frac{24.3}{(PQ)}$ **or** $\sin 27 = \frac{24.3}{(PQ)}$ **or** $\frac{(PQ)}{\sin 90} = \frac{24.3}{\sin 27}$ **or** $\frac{\sin 90}{(PQ)} = \frac{\sin 27}{24.3}$ oe		3	M1 for a correct trigonometric ratio	M2 for $(RQ =) 24.3 \times \tan 63 (= 47.6914..)$ oe **and** $(PQ =) \sqrt{'47.6914'^2 + 24.3^2}$ oe
		$(PQ =) \frac{24.3}{\cos 63}$ **or** $(PQ =) \frac{24.3}{\sin 27}$ **or** $(PQ) = \frac{24.3}{\sin 27} \times \sin 90$			M1 for a correct rearrangement for PQ	
			53.5		A1 Accept 53.5 - 53.53	
						Total 3 marks

6 (a)			2	B1	for $\frac{13}{20}$ and $\frac{7}{20}$ on the first branch (0.65 and 0.35)
		Correct probabilities on the tree diagram		B1	for $\frac{12}{19}, \frac{7}{19}, \frac{13}{19}$ and $\frac{6}{19}$ on the second branch (accept 2 dp or better 0.6315..., 0.3684..., 0.6842..., 0.3157...)
(b)	$\frac{7}{20} \times \frac{6}{19}$ oe only		2	M1	ft from (a) as long as probabilities less than 1
	$\frac{21}{190}$	$\frac{21}{190}$		A1	for $\frac{21}{190}$ oe or 0.11… (at least 2 dp)
					Total 4 marks

7		120 ÷ (3 + 5) (= 15)		6	M1	M2 for $\frac{3}{8}\times 120 (= 45)$ **or** $\frac{5}{8}\times 120 (= 75)$ oe
		'15' × 3 (= 45) **or** '15' × 5 (= 75)			M1	
		'45' ÷ 3 (= 15) **or** '45' ÷ 3 × 2 (= 30)			M1	
		'75' × $\frac{16}{25}$ (= 48) **or** '75' × $\frac{9}{25}$ (= 27)			M1	
		E.g. ('45' ÷ 3 × 2) + ('75' × $\frac{9}{25}$) oe **or** '27' + '30' **or** ('75' – '48') + ('45' – '15')			M1 for a complete method	
			57		A1	
						Total 6 marks

8 *(a)*	545 – 500 (= 45) **or** 592 – 545 (= 47)		4	M1	may be seen as part of a calculation	
	$\frac{45}{500}\times100(=9)$ **or** $\frac{47}{545}\times100(=8.6)$			M1	for one correct expression (allow 8 or 8.7 from a correct expression for 8.6 throughout)	
	$\frac{45}{500}\times100(=9)$ **and** $\frac{47}{545}\times100(=8.6)$			M1	for both correct expressions **or** having found "9%" finds 109% of 545: 1.09 × 545(=594.05) or 9% of 545 (49.05) or having found "8.6%" finds 108.6% of 500: 1.086 × 500(=543) or 8.6% of 500 (43)	
		No, 9(%) and 8.6(%)		A1	for no oe, 9% and 8.6% seen or no oe and 9% and 594.05 or 8.6% and 543 or No, 49.05 > 45 or No 594.05 > 592 oe	
Alternative mark scheme for 8(a)						
	$\frac{545}{500}\times100(=109)$ or $\frac{545}{500}(=1.09)$ **or** $\frac{592}{545}\times100(=108.6)$ or $\frac{592}{545}(=1.086)$		4	M3	for both correct expressions which should lead to 109 **or** 1.09 **and** 108.6 **or**1.086 (allow 108 or 108.7 from correct working for 108.6 or 1.08 or 1.087 from correct working for 1.086 throughout) (if not M3 then award M2 for one of these expressions)	
	$\frac{545}{500}\times100(=109)$ or $\frac{545}{500}(=1.09)$ **and** $\frac{592}{545}\times100(=108.6)$ or $\frac{592}{545}(=1.086)$					
		No, 109(%) and 108.6(%)		A1	oe eg no and 1.09 and 1.086	
(b)	952 ÷ 85 × 100 oe (=1120)		3	M1	for a method to find price before discount	M2 for $\frac{952}{85}\times15$
	0.15 × "1120" or "1120" – 952 oe			M1	for a correct method to find discount	
		168		A1		
						Total 7 marks

9	**Litres per amount of money and then conversion**			
	$\frac{8.6\times10^5}{770\,000}(=1.1168)\,l/\$$			M1 Number of litres per $ for D
	$\frac{4.2\times10^5}{2500\,000}(=0.168)\,l/\text{k}$			M1 Number of litres per Krone for A
	A: *l*/$ to *l*/k '1.1168' ÷ 6.57 (= 0.1699..)or D: *l*/k to *l*/$ '0.168' × 6.57 (= 1.103..)			M1 *l*/$ to *l*/k for A or *l*/k to *l*/$ for D
		Arctic Oil and relevant figures		A1 for Arctic Oil with 1.1168… and 1.10376… **or** 0.168 and 0.1699..
	Conversion then litres per amount of money			
	$\frac{2\,500\,000}{6.57}$(=380517.5..)or 770 000 × 6.57(= 505 8900)			M1 Changing Krone to $ or $ to Krone
	$\frac{4.2\times10^5}{2500\,000}(=0.168)$ or $\frac{4.2\times10^5}{'380517.5'}(=1.103..)$			M1 Litres per Krone or litres per $ for D
	$\frac{8.6\times10^5}{770\,000}(=1.1168)$ or $\frac{8.6\times10^5}{'5058\,900'}(=0.1699..)$			M1 Litres per Krone or litres per $ for A
		Arctic Oil and relevant figures		A1 for Arctic Oil with 1.1168… and 1.10376… **or** 0.168 and 0.1699..
	Cost per litre then conversion			
	$\frac{2500\,000}{4.2\times10^5}(=5.952..)$			M1 Price per litre in Krone for D
	$\frac{770\,000}{8.6\times10^5}(0.895..)$			M1 Price per litre in $ for A
	'5.952' ÷ 6.57(=0.9059..) or '0.895' × 6.57(= 5.882..)			M1 Conversion of Krone to $ or $ to Krone
		Arctic Oil and relevant figures		A1 For Arctic Oil with 5.952 and 5.882 **or** 0.895 and 0.9059

9	**Conversion then cost per litre**				
	$\frac{2\,500\,000}{6.57}(=380517.5..)$ or 770 000 × 6.57(= 505 8900)				M1 Changing Krone to $ or $ to Krone
	$\frac{2500\,000}{4.2\times10^5}(=5.952)$ or $\frac{'380517.5..'}{4.2\times10^5}(=0.9059..)$				M1 Cost per litre in Krone or cost per litre in $ for D
	$\frac{770\,000}{8.6\times10^5}(=0.895)$ or $\frac{'5058900'}{8.6\times10^5}(=5.882..)$				M1 Cost per litre in $ or cost per litre in Krone for A
			Arctic Oil and relevant figures		A1 For Arctic Oil with 5.952 and 5.882 **or** 0.895 and 0.9059
	Comparing equal amounts				
	$\frac{8.6\times10^5}{4.2\times10^5}(=\frac{43}{21}=2.047..)$	$\frac{4.2\times10^5}{8.6\times10^5}(=\frac{21}{43}=0.488..)$			M1 Multiplier for same amount of D as A or same amount of A as D
	'2.047..'×2500 000 K (=5119047.619..)K	'2.047..' × 770 000 $ (=376046.511..)$			M1 Cost of equal amount of D as A or A as D
	'5119047.619'÷6.57 = 779154.88…$ or 770 000×6.57=5058900 K	'376046.511..'× 6.57 =2470625.58..K or 2500 000÷6.57 = 380517..$			M1 Converts so can compare costs – either K to $ or original A to K or $ to K or original D to $
			Arctic Oil and relevant figures		A1 Arctic Oil and 779154.. or with 2470625..(figures may be rounded) Or Arctic Oil with 5119047… and 5058900 or with 376046.. and 380517
Students may compare other equal amounts – please use the scheme that best fits their method and award marks appropriately.					
					Total 4 marks

10	50×60 (= 3000) or $50 \div 1000$ (= 0.05 or $\frac{1}{20}$) or $50 \times 60 \times 60$ (= 180 000) or or $\frac{60\times60}{1000}(=3.6)$ or $1000 \div 60 \div 60$ (= 0.27777…. or $\frac{5}{18}$)		3	M1	for 50 with at least one of ÷ 1000 or × 60 or $\frac{60\times60}{1000}(=3.6)$ or $1000 \div 60 \div 60$
	$50\times\frac{60\times60}{1000}$ oe eg $50 \div \frac{5}{18}$			M1	(dep) for a complete method
		180		A1	for 180 (SCB1 for both conversion factors correct but applying them wrongly eg $\frac{50\times1000}{60\times60}$)
					Total 3 marks

11	(a)	$\frac{5+13}{2}$ or $\frac{-4+1}{2}$		2	M1 for a correct method to find one coordinate **or** for one coordinate correct **or** for (−1.5, 9)
			(9, −1.5)		A1 Accept $(9, -\frac{3}{2})$
	(b)		−3	1	B1
	(c)		No with reason	1	B1 No (oe) and e.g. line goes through (100, −298) or (101.3..), −302) or $\left(\frac{304}{3}, -302\right)$ or (3 × 100) – 302 = −2 not (+)2
					Total 4 marks

12		6000×1.015^2 (= 6181.35) **or** 6000 + (0.015 × 6000) + (0.015 × (6000 + '90')) (= 6181.35) **or** $(1.015)^2$ (= 1.030225) **or** $\frac{6311.16}{6000}\left(=1.05186\right)$		3	M1 for working out the total amount after **two** years **or** working out the compound interest multiplier after two years **or** working out the compound interest multiplier after three years
		6311.16 ÷ '6181.35' (= 1.021) (×100) **or** $\frac{6311.16-'6181.35'}{'6181.35'}$ (= 1.021) (×100) **or** '1.05186' ÷ '1.030225' (= 1.021) (×100)			M1 (dep on M1) for a complete method to find the compound interest multiplier (×100)
			2.1		A1 awrt 2.1
					Total 3 marks

13		$0.14=\frac{56}{w^2}$ oe **or** 56 ÷ 0.14 (= 400)		4	M1 for using the given formula correctly
		$\sqrt{\frac{56}{0.14}}$ **or** $\sqrt{'400'}$ (=20)			M1 for a method to find *w*
		'20' × '20' × '20' oe			M1 (dep on M2) for a method to find the volume of the cube
			8000		A1
					Total 4 marks

14		$(AH =)\sqrt{6^2+5^2+9^2}$ $(=\sqrt{142})$ **or** $(FH = GE =)\ \sqrt{5^2+9^2}$ $(=\sqrt{106})$		4	M1 for working out AH or FH or GE
		E.g. $\sin AHF = \frac{6}{'\sqrt{142}'}$ **or** $\tan AHF = \frac{6}{'\sqrt{106}'}$ **or** $\cos AHF = \frac{'\sqrt{106}'}{'\sqrt{142}'}$ **or** $\sin FAH = \frac{'\sqrt{106}'}{'\sqrt{142}'}$ **or** $\cos FAH = \frac{6}{'\sqrt{142}'}$ **or** $\tan FAH = \frac{'\sqrt{106}'}{6}$			M1 for a correct method for finding angle AHF **or** finding angle FAH Allow $\cos AHF = \left(\frac{'\sqrt{142}'^2+'\sqrt{106}'^2-6^2}{2\times'\sqrt{142}'\times'\sqrt{106}'}\right)$oe **or** $\sin AHF = \frac{\sin 90}{'\sqrt{142}'}\times 6$oe
		E.g. $\sin^{-1}\left(\frac{6}{'\sqrt{142}'}\right)$ **or** $\tan^{-1}\left(\frac{6}{'\sqrt{106}'}\right)$ **or** $\cos^{-1}\left(\frac{'\sqrt{106}'}{'\sqrt{142}'}\right)$ **or** $90-\sin^{-1}\left(\frac{'\sqrt{106}'}{'\sqrt{142}'}\right)$ **or** $90-\cos^{-1}\left(\frac{6}{'\sqrt{142}'}\right)$ **or** $90-\tan^{-1}\left(\frac{'\sqrt{106}'}{6}\right)$			M1 for a complete method Allow $\cos^{-1}\left(\frac{'\sqrt{142}'^2+'\sqrt{106}'^2-6^2}{2\times'\sqrt{142}'\times'\sqrt{106}'}\right)$oe **or** $\sin^{-1}\left(\frac{\sin 90}{'\sqrt{142}'}\times 6\right)$oe
			30.2		A1 for 30.2 – 30.3
					Total 4 marks

15	(a)	(0.5 ×) 9.3 × 14.7 × sin106 **or** (9.3 × cos 16) × 14.7 **or** (9.3 × sin 74) × 14.7		2	M1 for applying the area of a triangle formula using correct values (to find half of the area of the parallelogram) **or** for a correct method to find the area of the parallelogram
			131		A1 awrt 131
	(b)	(GE^2 =) $9.3^2 + 14.7^2 - 2 \times 9.3 \times 14.7 \times \cos 106$		3	M1 for the correct use of the cosine rule
		377(.9….) **or** 378 **or** 86.49 + 216.09 + 75.3… **or** 302.58 + 75.3….			M1 (dep on M1)for the correct order of operations
			19.4		A1 for 19.4 – 19.5
					Total 5 marks

16		58.35 or 58.45 or 19.5 or 20.5 or 3.55 or 3.65		3	B1 for any correct bound Accept $58.44\dot{9}$ for 58.45 or $20.4\dot{9}$ for 20.5 or $3.64\dot{9}$ for 3.65
		$\frac{2\times 58.45-19.5}{3.55}$ (= 27.4366...)			M1 for correct substitution into $\frac{2\times a_{UB}-c_{LB}}{d_{LB}}$ where $58.4 < a_{UB} \leq 58.45$ **and** $19.5 \leq c_{LB} < 20$ **and** $3.55 \leq d_{LB} < 3.6$
			27.44		A1 from correct working allow 27.4 – 27.5
					Total 3 marks

17	Angle $CAD = 28°$ or angle $ACB = 32°$ or angle $ACD = 90°$ or angle $ABD = 90°$		4	M1	
		30°		A1	For a correct answer of 30
	Angles in the **same segment** are equal, **angle** in a **semicircle** is 90° (or **angle** at centre is **double** angle at **circumference** oe) angles in a **triangle** add up to **180°**/**angles** in a **triangle** **isosceles** triangle **alternate** angles vertically **opposite angles (or vertically opposite)** **angles** at a **point** **opposite angles** in a **cyclic quad**rilateral angle between **tangent** and **radius (diameter)** **alternate segment** theorem **angles subtended** by the **same arc(**or **chord**) at the **circumference** (or **on the circle)**			B2	Dep on M1 for all correct reasons for their method used (if not B2 then award B1(dep on M1) for a correct circle theorem reason)
					Total 4 marks

18	$1600 = \frac{1}{3} \times \pi \times r^2 \times 25$ oe		6	M1	for substituting into volume formula for cone correctly and equating to 1600
	eg $r = \sqrt{\frac{1600}{\frac{1}{3} \pi \times 25}}$ or $r = \sqrt{\frac{192}{\pi}} (= \sqrt{61.1(154..)} = 7.8176...)$			M1	dep for correct rearrangement of volume formula for r
	$l = \sqrt{"7.817..."^2 + 25^2} (= \sqrt{686.1154...} = 26.193...)$			M1	Dep on M2 correct method to find slant height of cone (radius of sector)
	$2 \times \pi \times$ "7.817…" (= 49.1196…) **or** $\pi \times "7.817..." \times "26.193..." (= 643.315...)$			M1	for using $C = 2\pi r$ oe using figures from correct method **or** for using $A = \pi rl$ using figures from correct method
	$"49.1196..." = 2 \times \pi \times "26.193..." \times \frac{x}{360}$ **or** $"643.315..." = \pi \times "26.193..."^2 \times \frac{x}{360}$			M1	for using arc length = $2\pi r \times \frac{x}{360}$ **or** for using area of sector = $\pi r^2 \times \frac{x}{360}$
		107°		A1	for 107° – 108°
					Total 6 marks

19	$\frac{4}{16}\times\frac{3}{15}\times\frac{2}{14}\left(=\frac{24}{3360}=\frac{1}{140}\right)$oe **or** $\frac{7}{16}\times\frac{6}{15}\times\frac{5}{14}\left(=\frac{210}{3360}=\frac{1}{16}\right)$oe **or** $\frac{5}{16}\times\frac{4}{15}\times\frac{3}{14}\left(=\frac{60}{3360}=\frac{1}{56}\right)$oe		4	M1 for finding *BBB* **or** *OOO* **or** *LLL*	M3 for $\frac{11}{16}\times\frac{10}{15}\times\frac{9}{14}$oe
	$\frac{4}{16}\times\frac{7}{15}\times\frac{6}{14}\left(=\frac{168}{3360}=\frac{1}{20}\right)$oe **or** $\frac{4}{16}\times\frac{3}{15}\times\frac{7}{14}\left(=\frac{84}{3360}=\frac{1}{40}\right)$oe **or** $\frac{5}{16}\times\frac{4}{15}\times\frac{4}{14}\left(=\frac{80}{3360}=\frac{1}{42}\right)$ oe **or** $\frac{5}{16}\times\frac{4}{15}\times\frac{7}{14}\left(=\frac{140}{3360}=\frac{1}{24}\right)$ oe **or** $\frac{5}{16}\times\frac{4}{15}\times\frac{3}{14}\left(=\frac{60}{3360}=\frac{1}{56}\right)$ oe **or** $\frac{5}{16}\times\frac{7}{15}\times\frac{6}{14}\left(=\frac{210}{3360}=\frac{1}{16}\right)$ oe **or** $\frac{5}{16}\times\frac{7}{15}\times\frac{4}{14}\left(=\frac{140}{3360}=\frac{1}{24}\right)$ oe **or** $\frac{5}{16}\times\frac{4}{15}\times\frac{11}{14}\left(=\frac{220}{3360}=\frac{11}{168}\right)$oe or $\frac{5}{16}\times\frac{11}{15}\times\frac{10}{14}\left(=\frac{550}{3360}=\frac{55}{336}\right)$ oe			M1 for finding the following in any order *BOO* **or** *BBO* **or** *LLB* **or** *LLO* **or** *LBB* **or** *LOO* **or** *LOB* **or** *LLX* **or** *LXX* (*X* = not *L*)	
	$'\frac{24}{3360}'+3\times'\frac{84}{3360}'+'\frac{210}{3360}'+3\times'\frac{168}{3360}'$oe **or** $1-\left('\frac{60}{3360}'+3\times'\frac{80}{3360}'+3\times'\frac{140}{3360}'+3\times'\frac{60}{3360}'3\times'\frac{210}{3360}'6\times'\frac{140}{3360}'\right)$oe **or** $1-\left('\frac{60}{3360}'+3\times'\frac{220}{3360}'+3\times'\frac{550}{3360}'\right)$oe			M1 for a complete method	
		$\frac{990}{3360}$		A1 for $\frac{990}{3360}$ oe e.g. $\frac{33}{112}$or 0.29(464...)	
					Total 4 marks

		Practice Papers Set 12 – 2H-3H				Edexcel averages: scores of candidates who achieved grade:							
Qn	**Paper**	**Question**	**Skill tested**	**Max score**	**Mean %**	**ALL**	**9**	**8**	**7**	**6**	**5**	**4**	**3**
1	**2H**	Q09	Measures	2	82	1.64	1.99	1.95	1.86	1.74	1.52	1.34	1.15
2	**1H**	Q04	Probability	7	78	5.49	6.92	6.74	6.40	5.96	5.29	4.26	3.33
3	**2H**	Q06	Probability	4	75	2.99	3.93	3.83	3.64	3.26	2.94	2.04	1.35
4	**1H**	Q06	Standard form	3	78	2.33	2.93	2.82	2.69	2.51	2.21	1.85	1.53
5	**1H**	Q09	Trigonometry and Pythagoras' Theorem	3	71	2.12	2.92	2.84	2.69	2.40	1.96	1.34	0.55
6	**2H**	Q14	Probability	4	63	2.50	3.88	3.57	3.27	2.62	1.79	1.15	0.80
7	**1H**	Q05	Ratio and proportion	6	65	3.92	5.71	5.29	4.79	4.40	3.55	2.29	1.34
8	**2H**	Q08	Percentages	7	65	4.54	6.64	6.19	5.39	4.74	3.88	2.68	1.85
9	**2H**	Q12	Applying number	4	63	2.50	3.69	3.25	2.92	2.58	2.15	1.63	1.09
10	**2H**	Q10	Measures	3	60	1.81	2.85	2.43	2.13	1.71	1.42	1.15	0.73
11	**1H**	Q01	Graphs	4	53	2.11	3.66	3.38	2.72	1.96	1.34	0.78	0.50
12	**1H**	Q11	Percentages	3	56	1.69	2.76	2.44	2.03	1.64	1.35	0.91	0.54
13	**1H**	Q13	Measures	4	52	2.08	3.76	3.28	2.61	1.91	1.32	0.72	0.49
14	**1H**	Q19	Trigonometry and Pythagoras' Theorem	4	43	1.73	3.86	3.36	2.29	1.24	0.43	0.14	0.05
15	**1H**	Q14	Trigonometry and Pythagoras' Theorem	5	44	2.19	4.35	3.81	2.78	2.03	0.97	0.51	0.22
16	**1H**	Q16	Degree of accuracy	3	42	1.26	2.70	2.33	1.61	0.99	0.47	0.19	0.09
17	**2H**	Q13	Circle properties	4	39	1.55	2.96	2.40	1.77	1.42	1.01	0.64	0.36
18	**2H**	Q26	3D shapes and volume	6	33	1.96	4.64	3.33	2.31	1.42	0.75	0.40	0.14
19	**1H**	Q18	Probability	4	25	1.00	2.88	1.89	1.03	0.48	0.21	0.02	0.00
			TOTAL	**80**	**57**	**45.41**	**73.03**	**65.13**	**54.93**	**45.01**	**34.56**	**24.04**	**16.11**

Suggested grade boundaries

Grade	9	8	7	6	5	4	3
Mark	69	60	50	40	29	20	16