SECTOR AREAS AND ARC LENGTH

Pearson Edexcel – Thursday 4 June 2020 - Paper 2 (Calculator) Higher Tier

1.

7	35.3	P1	for starting the process to find length of third side of triangle, eg $9^2 - 6^2$ (= 45) **or** $6^2 + x^2 = 9^2$	
		P1	for $\sqrt{9^2 - 6^2}$ or $\sqrt{81 - 36}$ or $\sqrt{45}$ or $3\sqrt{5}$ (= 6.7..) **or** $r^2 = 45$	
		P1	for stating or using $\pi \times$ [radius]$^2 \div 4$	[radius] is any value
		A1	for answer in range 35.2 to 35.4	If an answer in the range 35.2 to 35.4 is given in the working space then incorrectly rounded, award full marks No working, answer only, no marks

Pearson Edexcel – Thursday 4 June 2020 - Paper 2 (Calculator) Higher Tier

2.

18	160π	P1	for process to find curved surface area of cone, eg $\pi \times 10 \times 25$ (= 250π) (= 785…..)	
		P1	for process to find the radius or diameter of the smaller cone eg $10 \times \frac{15}{25}$ (= 6) **or** $20 \times \frac{15}{25}$ (= 12) oe **OR** uses area scale factor, eg "250π" $\times \left(\frac{15}{25}\right)^2$ (= 90π)	15 comes from 25 – 10 $\frac{15}{25}$ may be seen as 0.6
		P1	for a complete process, eg "250π" – $\pi \times$ "6" $\times$ 15 (= 785… – 282…) **or** answer in range 502 to 503	
		A1	for 160π	Award 0 marks for an answer of 160π or an answer in range 502 to 503 with no supportive working. If 160π seen but answer in range 502 to 503 given on answer line isw and award full marks

Pearson Edexcel – Monday 8 June 2020 - Paper 3 (Calculator) Higher Tier

3.

19	Proof	P1	for start to process to find area of *ABCDEF*, eg area of equilateral triangle $= \frac{1}{2} \times x \times x \times \sin 60 \left(= \frac{\sqrt{3}}{4}x^2\right)$ **OR** for start to process to find area of *FGHIJK*, eg area of equilateral triangle $= \frac{1}{2} \times px \times px \times \sin 60 \left(= \frac{\sqrt{3}}{4}p^2x^2\right)$	Any correct process to find the area of part of the hexagon is acceptable for this mark, eg $\frac{1}{2} \times x \times x \times \sin 120$ or $\frac{1}{2} \times (x + 2x) \times \frac{\sqrt{3}}{2}x$ Allow sin 60 left in expressions for the first 3 marks.
		P1	for complete process of finding area of *ABCDEF*, eg $6 \times \frac{1}{2} \times x \times x \times \sin 60$ or $6 \times \frac{1}{2} \times x \times x \times \frac{\sqrt{3}}{2}$ $\left(= \frac{3\sqrt{3}}{2}x^2\right)$ oe **OR** for complete process of finding area of *FGHIJK*, eg $6 \times \frac{1}{2} \times px \times px \times \frac{\sqrt{3}}{2}$ $\left(= \frac{3\sqrt{3}}{2}p^2x^2\right)$ oe	
		P1	for process of finding area of *ABCDEF* eg $\frac{3\sqrt{3}}{2}x^2$ oe **AND** for process of finding area of *FGHIJK*, eg $p^2 \times \frac{3\sqrt{3}}{2}x^2$ oe	
		C1	correct algebra leading to given result, $\frac{3\sqrt{3}}{2}(p^2 - 1)x^2$	Accept $\frac{3\sqrt{3}}{2}x^2(p^2 - 1)$ as final result.

Pearson Edexcel - Thursday 6 June 2019 - Paper 2 (Calculator) Higher Tier

4.

12	25.4	P2	for finding the size of the angle eg $\frac{40 \times 360}{\pi \times 7^2}$ (=93.5(4..)) **or** for working with proportion, eg $\frac{40}{49\pi}$ (=0.259(8…) or 0.26) **or** $\frac{49\pi}{40}$ (=3.84(8…) or 3.85)	
		(P1	for finding the area of the circle eg $\pi \times 7^2$ (=153(.938..) or 154))	May be embedded
		P1	(dep on P2) for a process to find the arc length, eg $\frac{\text{"93.5(4...)"}}{360} \times \pi \times 2 \times 7$ (=11.4(28…)) **or** $\frac{40}{49\pi} \times \pi \times 2 \times 7$ (=11.4(28…)) **or** $\pi \times 2 \times 7 \div \frac{49\pi}{40}$ (=11.4(28…))	
		A1	for answer in the range 25 to 25.44	If an answer is shown in the range in working and then incorrectly rounded award full marks. Accept $\frac{178}{7}$

Pearson Edexcel - Tuesday 6 November 2018 - Paper 1 (Non-Calculator) Higher Tier

5.

7	shown	C1	for method to find area of semicircle, eg $\pi \times 10^2 \div 2$ (= 50π)	Can award first 3 marks if a value for π is used
		C1	for method to find area of quarter circle, for $\pi \times 20^2 \div 4$ (= 100π)	
		C1	for a complete method to find area shaded **and** area of square, eg $\pi \times 20^2 \div 4 - \pi \times 10^2 \div 2$ **and** 20×20	Working out to find the area of the shaded region **must** be shown
		C1	fully correct working leading to $\frac{\pi}{8}$	

Pearson Edexcel - Thursday 2 November 2017 - Paper 1 (Non-Calculator) Higher Tier

6.

4		Daisy is wrong (supported)	P1 P1 A1 C1	for process to find area of any relevant circle ie $\pi\times4^2$ (=16π), $\pi\times7^2$ (=49π), $\pi\times10^2$ (=100π) **or** 7^2 and 4^2 for completed method to find shaded area eg "$\pi\times7^2$" – "$\pi\times4^2$" (=33π) **or** use of radii eg $7^2 - 4^2$ (=33) for 2 comparable figures, eg 33π and 100π **or** 33 and 100 **or** 103 to 103.7 and 314 to 314.2 **or** 103 to 103.7 and 104.6 to 104.8 statement eg No because it should be $\frac{33}{100}$ and their accurate figures Allow use of π = 3 or better

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7.

20		68.5	B1 P1 P1 P1 A1	for angle *OAB* = 90° or angle *OCB* = 90°, may be seen on diagram for a process to find the length of *AB* or the length of *CB* (= 10√3 oe) eg 10 × tan 60° (= 17.3...) or the length of *OB* (= 20), eg 10 ÷ cos 60° for a process (dep previous P1) to find the area of the triangle *OAB* (= 50√3 oe) or area of triangle *OCB* (= 50√3 oe) or area of kite *OABC* (= 100√3 oe) for a process to find the area of the sector *OAC* e.g. $\frac{1}{3} \times \pi \times 10^2$ (= 104.7...),accept rounded or truncated to 3 significant figures or more for 68.4 – 68.6

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8.

17		66.5	B1 P1 P1 P1 A1	for recognising an angle of 60 at *AOB* for a process to find the area of the sector, e.g. $\frac{"60"}{360} \times \pi \times 11^2$ (= 63.3.. or $\frac{121\pi}{6}$) for a process to find the area of the triangle, e.g. $\frac{1}{2} \times 7^2 \times \sin "60"$ (=21.2.. or $\frac{49\sqrt{3}}{4}$) for a process to find the required percentage, eg. $\frac{"63.3.."-"21.2.."}{"63.3.."} \times 100$ for answer in the range 66.5 to 66.6

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9.

18	Note *DOC=DOA*, *ADO=CDO*	21.6	P1 P1 P1 P1 A1	Recognises that *OAD* or *OCD* is 90° or right angle for using trigonometry to set up an equation in *DOA* or *ADO* eg Cos *DOA* = $\frac{5}{9}$ for using inverse trigonometry to find *DOA* or *ADO* eg *DOA* = $\text{Cos}^{-1}\frac{5}{9}$ (= 56.25…) for a complete process to find arc length *ABC* or *AC* eg $\frac{360-2\times"56.25.."}{360} \times 2\times\pi\times5$ (=21.598..) or $\frac{2\times"56.25.."}{360} \times 2\times\pi\times5$ (=9.8174..) for answer in the range 21.5 to 21.65

Pearson Edexcel - Specimen Papers Set 2 - Paper 1 (Non-Calculator) Higher Tier

10.

2	$16 \div 4$ $\frac{1\times4}{2}=2$ or $\frac{1}{2}\times\frac{1}{4}=\frac{1}{8}$ $\frac{2\times4}{2}=4$ or $\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$ $\frac{1\times4}{2}+\frac{2\times4}{2}=6$ or $\frac{1}{2}\times\frac{1}{4}+\frac{1}{2}\times\frac{1}{2}=\frac{3}{8}$ $16-6=10$ or $1-\frac{3}{8}=\frac{5}{8}$	$\frac{5}{8}$	P1 P1 P1 P1 A1	Using side lengths of 4 Method to find fraction or area for one unshaded triangle Method to complete fraction or area for total unshaded region Method to find total fraction or area for shaded region for $\frac{5}{8}$ oe or 0.625

Pearson Edexcel - Specimen Papers Set 2 - Paper 2 (Calculator) Higher Tier

11.

7	$\frac{1}{4}\times\pi\times4.8^2$ $\frac{1}{2}\times4.8\times4.8$ $\frac{1}{4}\times\pi\times4.8^2-\frac{1}{2}\times4.8\times4.8$	6.58	B1 P1 A1	for use of formula for area of a circle for complete process to find area of shaded region for 6.56 – 6.58

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12.

16		18.2	M1 A1	for $\frac{260}{360}\times\pi\times8$ oe or $\frac{100}{360}\times\pi\times8$ oe for 18.1 to 18.2

Pearson Edexcel - Sample Paper 2 - (Calculator) Higher Tier

13.

17		4.89	M1 A1	$\frac{40}{360}\times2\times\pi\times7$ oe 4.8 – 4.9

Pearson Edexcel - Sample Paper 3 - (Calculator) Higher Tier

14.

1		252	P1 M1 P1 A1	For start to process eg. radius = 12 ÷ 4 (=3) Method to find area of trapezium or semicircle or circle Process to find area of the shaded region 251.7 – 252

Pearson Edexcel - Thursday 26 May 2016 - Paper 1 (Non-Calculator) Higher Tier

15.

12		$100 - 25\pi$	3	M1 for $\pi \times 5 \times 5$ or 25π M1 for $(10 \times 10 - "\pi \times 5 \times 5")$ A1 for $100 - 25\pi$ oe NB: ignore the inclusion of any units.

Pearson Edexcel - Thursday 26 May 2016 - Paper 1 (Non-Calculator) Higher Tier

16.

25		$\frac{1}{4} - \frac{\sqrt{6}}{12}$	3	M1 for $\frac{1}{2} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{2}}{2}$ or $\frac{1}{2} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{3}$ M1 for $\frac{1}{2} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{2}}{2} - \frac{1}{2} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{3}$ A1 for $\frac{1}{4} - \frac{\sqrt{6}}{12}$ oe OR M1 for $(BC =) \frac{\sqrt{2}}{2} - \frac{\sqrt{3}}{3}$ M1 for $\frac{1}{2} \times \left\{\frac{\sqrt{2}}{2} - \frac{\sqrt{3}}{3}\right\} \times \frac{\sqrt{2}}{2}$ A1 for $\frac{1}{4} - \frac{\sqrt{6}}{12}$ oe

Pearson Edexcel - Wednesday 5 November 2014 - Paper 1 (Non-Calculator) Higher Tier

17.

18	(a)		7.5	2	M1 for $\frac{12}{18}$ oe **or** $\frac{18}{12}$ oe **or** $\frac{12}{5}$ oe **or** $\frac{5}{12}$ oe A1 cao
	(b)		45	3	M1 for $\left("\frac{3}{2}"\right)^2$ oe or $\left("\frac{2}{3}"\right)^2$ oe M1 for complete method to find area of shaded region, eg $36 \times "1.5"^2 - 36$ A1 cao (SC B2 for 81)

Pearson Edexcel - Monday 4 March 2013 - Paper 2 (Calculator) Higher Tier

18.

19		$\frac{30}{360} \times \pi \times 15^2$	58.8	2	M1 for a correct method to find the area of sector *OAB* A1 for answer in range 58.8 – 58.9125

Pearson Edexcel - Tuesday 6 November 2012 - Paper 1 (Non-Calculator) Higher Tier

19.

12			$36 - 9\pi$	3	M1 for $\pi \times 6 \times 6$ or 36π seen value 113.03-113.2 M1 for $(12 \times 12 - '\pi \times 6 \times 6') \div 4$ or value 7.7-7.8 A1 for $36 - 9\pi$ oe **OR** M1 for $\pi \times 6 \times 6 \div 4$ or 9π seen or value 28.2-28.3 M1 for $6 \times 6 - '\pi \times 6 \times 6 \div 4'$ or value 7.7-7.8 A1 for $36 - 9\pi$ oe NB: for M marks π may be given numerically.

Pearson Edexcel - Friday 2 March 2012 - Paper 3 (Non-Calculator) Higher Tier

20.

11		Area of $ABCD = 12^2 = 144$ $AN = 3$ cm Area of $AND = \frac{1}{2}\times'3'\times12 = 18$ cm^2 $MB = 6$ cm, $NB = 9$cm Area of $MBN = \frac{1}{2}\times6\times9 = 27$ cm^2 Area of shaded region = 144 – 27 – 18 **OR** $AN = 3$ cm or $BN = 9$ cm Area of rect **X** on $CM = 6\times9 = 54$ Area of triangle **Y** $= \frac{1}{2}\times6\times9 = 27$ Area of top triangle **Z** $= \frac{1}{2}\times3\times12 = 18$ Area of shaded region = 54+27+18	99 cm^2	6	B1 $AN = 3$ or $BN = 9$ or $CM = 6$ or $MB = 6$ M1 Area of $ABCD = 12\times12$ (= 144) M1 Area of $AND = \frac{1}{2}\times'3'\times12$ (=18) M1 Area of $MBN = \frac{1}{2}\times'6'\times'9'$ (=27) M1 (dep on at least 1 previous M1) for (Area of CMND =) '144' – '18' – '27' A1 cao **OR** B1 $AN = 3$ or $BN = 9$ or $CM = 6$ or $MB = 6$ M1 Area of rect on CM = '6'×'9' (=54) M1 area of adj $\Delta = \frac{1}{2}\times'6'\times'9'$ (=27) M1 area of top $\Delta = \frac{1}{2}\times'3'\times12$ (=18) M1 (dep on at least 1 previous M1) for '54'+'27'+'18' A1 cao
11 (contd)		**OR** $AN = 3$ cm or $BN = 9$ cm Area of $CNM = \frac{1}{2}\times6\times9 = 27$ cm^2 Area of $CND = \frac{1}{2}\times12\times12 = 72$ cm^2 Area of shaded region = 72 + 27 **OR** Area of $PDN = \frac{1}{2}\times'3'\times12 = 18$ cm^2 Area of $CMNP = \frac{1}{2}\times(12+'6')\times'9' = 81$ cm^2 Area of shaded region =18 + 81			**OR** B1 $AN = 3$ or $BN = 9$ or $CM = 6$ or $MB = 6$ M2 Area of $CNM = \frac{1}{2}\times'6'\times'9'$ (=27) M1 Area of $CND = \frac{1}{2}\times12\times12$ (= 72) M1 (dep on at least 1 previous M1) for '72' + '27' A1 cao **OR** B1 $AN = 3$ or $BN = 9$ or $CM = 6$ or $MB = 6$ M1 Area of $PDN = \frac{1}{2}\times'3'\times12$ (=18) M2 Area of $CMNP = \frac{1}{2}\times(12+'6')\times'9'$ (=81) M1 (dep on at least 1 previous M1) for '18' + '81' A1 cao

Pearson Edexcel - Monday 5 March 2012 - Paper 4 (Calculator) Higher Tier

21.

23		Area of sector = $\frac{35}{360}\times\pi\times80\times80$ $= \frac{35}{360}\times20106.19$ $= 1954$ Area of triangle $= \frac{1}{2}\times80\times80\times\sin35$ $= 3200\times0.573576$ $= 1835$ Area of segment = 1954 – 1835	119	5	M1 for $\frac{35}{360}$ oe or 0.0972(2…) seen or $\frac{360}{35}$ oe or 10.28(5…) seen or 10.29 seen or 10.3 seen M1 for $\frac{35}{360}\times\pi\times80\times80$ oe or sight of value in the range 1954 to 1955 M1 for ½ × 80 × 80 × sin 35 or 80 × sin 17.5 × 80 × cos 17.5 or sight of value in the range 1835 to 1836 M1 (dep on at least one M1 scored) for the intention to find area of sector $OABC$ - area of triangle OAC A1 for answer in the range 118 to 120 (B3 SC for Rads: 3324(.953305) or Grads: 282(.7733551)

Pearson Edexcel - Friday 10 June 2011 - Paper 4 (Calculator) Higher Tier

22.

5		$\pi(6)^2 - \pi(5)^2$ $= 113(.0973\ldots) - 78.5(398\ldots)$ $=34.55751919$	34.6	3	M1 for $\pi(6)^2$ oe or $\pi(5)^2$ oe or 113… or 78.5… M1 for $\pi(6)^2 - \pi(5)^2$ oe A1 for 34.5 - 34.6

Pearson Edexcel - Friday 11 June 2010 - Paper 4 (Calculator) Higher Tier

23.

26	$\frac{40}{360}\times\pi\times8^2 - \frac{1}{2}\times8^2\times\sin 40^o$ = 22.34.... – 20.569... OR $\frac{40}{360}\times\pi\times8^2 -$ $8\times\sin 20^o\times8\times\cos 20^o$ = 22.34.... – 20.569...	1.77	5	M1 for $\frac{40}{360}$ oe seen or $0.1\dot{1}$ seen or ÷9 M1 for $\frac{40}{360}\times\pi\times8^2$ oe or sight of 22.3-22.35 M1 for $\frac{1}{2}\times8^2\times\sin 40^o$ or $8\times\sin\ 20\times8\times\cos 20$ or sight of 20.56-20.57 M1 (dep on at least one M1 scored) for the intention to find the difference between the area of triangle ***OPS*** and the area of sector ***OPRS*** A1 for 1.74 -1.78 [B3: RAD: ±1.50(340…) or GRAD: 3.53(108…)]

OCR GSCE – Thursday 6 June 2019 – Paper 5 (Non-Calculator) Higher Tier

24.

15			$\frac{x}{360}\times\pi\times6^2$ or $\frac{[\pi\times]6^2}{[\pi\times]6}$ or shows $\pi\times6^2$ and $\frac{1}{6}$ oe	**M1**	Accept 36 for 6^2	x = angle AOX , condone any variable used For M1 may be seen in stages e.g. M1 for $36\pi \div 6$
			$\frac{x}{360}[\times\pi]\times6^2 = 6[\pi]$ or 360 ÷ 6	**M1dep**	Dep on previous M1	
			[x =] 60	**A1**		Must earn M1M1 before awarding A1
			$\frac{AX}{6} = \sin$*their*60 **oe**	**M1**	Dep on 0 < *their* 60 < 90 Accept use of cos 30 or cos 60 and Pythagoras' or sine rule with 90	Do not accept assumption that OX = 3 without any evidence
			$AX = 6\times\frac{\sqrt{3}}{2} = 3\sqrt{3}$ or $\frac{3\sqrt{3}}{6} = \frac{AX}{6}$, $AX = 3\sqrt{3}$	**M2**	or **M1** for $\sin 60 = \frac{\sqrt{3}}{2}$ or $\cos 30 = \frac{\sqrt{3}}{2}$ To award 6 marks, there must be no errors seen	Beware circular methods using $3\sqrt{3}$ leading to 60, this can only score M1 maximum for $\sin 60 = \frac{\sqrt{3}}{2}$ but ignore circular methods if alongside a correct method

OCR GSCE – Thursday 8 November 2018 – Paper 5 (Non-Calculator) Higher Tier

25.

12			15π	**5**	**B3** for [angle at centre]= 150 or sector is $\frac{5}{12}$ **oe** of circle or **M2** for $\frac{[360\times]5\pi}{2\times\pi\times6}$ or better or **M1** for $[\frac{\theta}{360}\times]2\times\pi\times6$ **oe** **M1** for $\frac{their\theta}{360}\times\pi\times6^2$ **oe**	Independent

OCR GSCE – Tuesday 6 November 2017 – Paper 5 (Non - Calculator) Higher Tier

26.

1	**(a)**		tangent	**1**		Ignore spelling providing intention is clear
	(b)		segment	**1**		Ignore spelling providing intention is clear

OCR GSCE – Wednesday 8 November 2017 – Paper 6 (Calculator) Higher Tier

27.

8			13.7	**5**	**M4** for $\frac{45}{360}\times2\times\pi\times6$ + $\frac{45}{360}\times2\times\pi\times2.5$ + 2 × 3.5 oe soi OR **M3** for $\frac{45}{360}\times2\times\pi\times6$ oe and $\frac{45}{360}\times2\times\pi\times2.5$ oe soi OR **M2** for $\frac{45}{360}\times2\times\pi\times6$ oe or $\frac{45}{360}\times2\times\pi\times2.5$ oe soi or $2\times\pi\times6$ + $2\times\pi\times2.5$ oe soi OR **M1** for $2\times\pi\times6$ oe or $2\times\pi\times2.5$ oe soi If **0** scored **SC2** for $\frac{45}{360}\times\pi\times6^2$ oe and $\frac{45}{360}\times\pi\times2.5^2$ oe soi by 14.1… and 2.45… or by 11.6 to 11.7 OR **SC1** for $\frac{45}{360}\times\pi\times6^2$ oe or $\frac{45}{360}\times\pi\times2.5^2$ oe soi by 14.1… or 2.45…	by 13.67… to 13.68 by 4.71… and 1.96… or by 6.67… to 6.68 by 4.71… or 1.96…or 53.4.. by 37.699… to 37.7 or 15.7… Method marks may be awarded for multiples of π seen in correct working. Eg. $\frac{45}{360}\times2\times\pi\times6=\frac{3}{2}\pi$ $\frac{45}{360}\times2\times\pi\times2.5=\frac{5}{8}\pi$

AQA GSCE – Tuesday 11 June 2019 – Paper 3 (Calculator) Higher Tier

28.

16	$\frac{x}{360} \times \pi \times (1.5r)^2$ or $\frac{1}{160}\pi x r^2$ or $0.019...xr^2$ or $\frac{2x}{360} \times \pi \times r^2$ or $\frac{1}{180}\pi x r^2$ or $0.017...xr^2$	M1	oe eg (working in radians) $\frac{1}{2} \times (1.5r)^2 \times x$ or $\frac{1}{2} \times r^2 \times 2x$
	$\frac{1}{160}\pi x r^2$ and $\frac{1}{180}\pi x r^2$ and A or $0.019...xr^2$ and $0.017...xr^2$ and A	A1	oe eg (working in radians) $\frac{9}{8}r^2x$ and r^2x and A
	Additional Guidance		
	Methods must be algebraic, containing x, π and r		
	If a box is not ticked, must say 'A' without contradiction in working to award M1A1		
	To award A1 their areas must be in a comparable form eg $\frac{2.25}{360}\pi x r^2$ and $\frac{2}{360}\pi x r^2$ and A ticked		
	Ignore further incorrect working after A1 scored		

AQA GSCE – Thursday 2 November 2017 – Paper 1 (Non - Calculator) Higher Tier

29.

7	$\pi \times 6 \times 6$ or 36π or [113, 113.112] or $9 \times$ [3.14, 3.142] or [28.26, 28.3]	M1	oe accept [3.14, 3.142] for π
	9π or $9 \times \pi$ or $\pi 9$ or $\pi \times 9$	A1	
	Additional Guidance		
	36π followed by an incorrect method eg $36\pi \div 2 = 18\pi$ with answer 18π		M1A0
	Answer of 9π from $\pi \times 3^2$		M0A0
	9π and [28.26, 28.3] given on answer line		M1A0
	πr^2 stated but followed by 36 or 9		M0A0

AQA GSCE – Thursday 6 November 2017 – Paper 2 (Calculator) Higher Tier

30.

22	**Alternative method 1**		
	$(\frac{1}{2} \times) \pi \times 25 \times 25$ or 625π or 312.5π or [1962.5, 1964] or [981, 982] or $\pi \times 12 \times 12$ or 144π or [452, 452.45]	M1	oe Area of circle or semicircle radius 25 or area of circle radius 12
	$\frac{150}{360}$ or $\frac{5}{12}$ or 0.41(6...) or 0.417 or 0.42 or $\frac{360}{150}$ or $\frac{12}{5}$ or 2.4	M1	May be seen in two steps eg $\times 150 \div 360$
	their $\frac{150}{360} \times \pi \times 12 \times 12$ or $\pi \times 12 \times 12 \div$ their $\frac{360}{150}$ or 60π or [188.4, 188.52]	M1dep	oe dep on M2 Area of sector
	$\frac{\text{their [188.4, 188.52]}}{\text{their [981, 982]}}$ $(\times 100)$ or [0.19, 0.1922] or [19, 19.22]	M1dep	oe dep on M3 their [981, 982] must be the area of semicircle radius 25
	[19, 19.22] and No or [0.19, 0.1922] and 0.2 and No	A1	

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22	**Alternative method 2**		
	$(\frac{1}{2} \times) \pi \times 25 \times 25$ or 625π or 312.5π or [1962.5, 1964] or [981, 982] or $\pi \times 12 \times 12$ or 144π or [452, 452.45]	M1	oe Area of circle or semicircle radius 25 or area of circle radius 12
	$\frac{150}{360}$ or $\frac{5}{12}$ or 0.41(6...) or 0.417 or 0.42 or $\frac{360}{150}$ or $\frac{12}{5}$ or 2.4	M1	May be seen in two steps eg $\times 150 \div 360$
	their $\frac{150}{360} \times \pi \times 12 \times 12$ or $\pi \times 12 \times 12 \div$ their $\frac{360}{150}$ or 60π or [188.4, 188.52]	M1dep	oe dep on M2 Area of sector
	their [188.4, 188.52] × 5 or [942, 942.6]	M1dep	oe dep on M3
	[942, 942.6] and [981, 982] and No	A1	oe eg 300π and 312.5π and No

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Additional Guidance is on the next page

22	**Alternative method 3**		
	$(\frac{1}{2} \times) \pi \times 25 \times 25$ or 625π or 312.5π or [1962.5, 1964] or [981, 982] or $\pi \times 12 \times 12$ or 144π or [452, 452.45]	M1	oe Area of circle or semicircle radius 25 or area of circle radius 12
	0.2 × their [981, 982] or 62.5π or [196.2, 196.4]	M1dep	oe dep on 1st M1 their [981, 982] must be the area of semicircle radius 25
	$\frac{150}{360}$ or $\frac{5}{12}$ or 0.41(6...) or 0.417 or 0.42 or $\frac{360}{150}$ or $\frac{12}{5}$ or 2.4	M1	May be seen in two steps eg × 150 ÷ 360
	their $\frac{150}{360} \times \pi \times 12 \times 12$ or $\pi \times 12 \times 12 \div$ their $\frac{360}{150}$ or 60π or [188.4, 188.52]	M1dep	oe dep on 1st M1 and 3rd M1 Area of sector
	[188.4, 188.52] and [196.2, 196.4] and No	A1	oe eg 60π and 62.5π and No
	Additional Guidance		
	Alt 3 20% of [981, 982] does not score 2nd M1 unless evaluated correctly		

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25	$15^2 + 26^2 - 2 \times 15 \times 26 \times \cos 38$ or [286, 286.4] or [16.9, 17]	M1	May be seen in a square root May be seen on diagram
	$\frac{108}{360}$ or 0.3 or $\frac{360}{108}$ or 3.33(…)	M1	oe eg 108 ÷ 360 or 30% May be seen in two steps eg × 108 ÷ 360
	their $\frac{108}{360} \times \pi \times$ [286, 286.4] or $\pi \times$ their [286, 286.4] ÷ their $\frac{360}{108}$ or [269, 272.4114]	M1dep	dep on 1st and 2nd M1 oe eg $\frac{108}{360} \times \pi \times$ (their [16.9, 17])^2
	(2 ×) $\frac{1}{2} \times 15 \times 26 \times \sin 38$ or [120, 120.1] or [240, 240.2]	M1	oe
	[509, 512.6114] and 510	A1	Must see a value in range [509, 512.6114] and 510
	Additional Guidance		
	15 × 26 × sin 38 scores 4th M1 unless subsequently doubled		
	If (sector) 270 and (2 triangles) 240 followed by 270 + 240 = 510		M4A1
	Working back from 510. Apply scheme but maximum mark is M4A0		
	Assuming angle *AEB* = 72 and then using sine rule to work out *BE* does lead to area = 510 to 2sf but can score a maximum of M0M1M0M1depA0 *BE* = $\frac{26}{\sin 72} \times \sin 38 = 16.8$ (or 17) $\frac{108}{360} \times \pi \times 16.8^2 = 266$ $2 \times \frac{1}{2} \times 15 \times 26 \times \sin 38 = 240.2$ 506.2 → 510		M0 M1M0depM1 A0
	BE = [16.9, 17] seen with no working scores first M1 (and possibly all other marks)		
	BE = 35 ÷ 2 = 17.5 → 17 does not score first M1		