Version : 08/06

ASSESSMENT and QUALIFICATIONS ALLIANCE

Free-Standing Mathematics Qualification

Solving Problems in Shape and Space
6985/2

Mark Scheme

2006 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Key to mark scheme and abbreviations used in marking

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation

√or ft or F	follow through from previous incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	OE	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
–*x* EE	deduct *x* marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

Application of Mark Scheme

No method shown:	
Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise
More than one method / choice of solution:	
2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only
Crossed out work	do not mark unless it has not been replaced
Alternative solution using a correct or partially correct method	award method and accuracy marks as appropriate

Free-Standing Mathematics Qualification

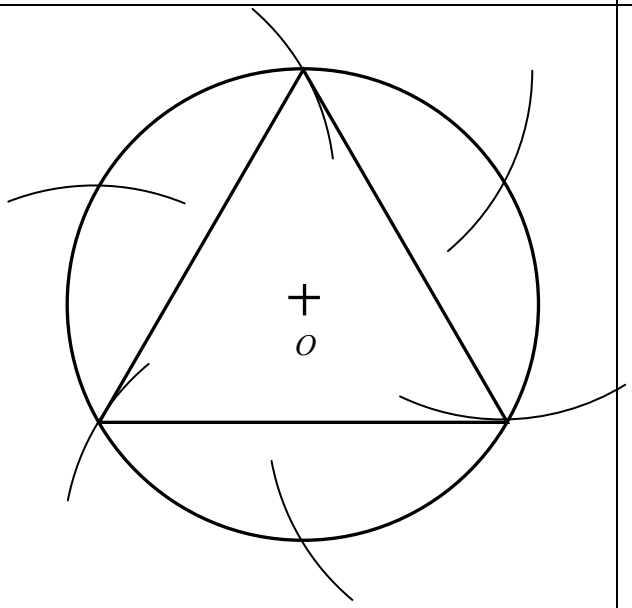
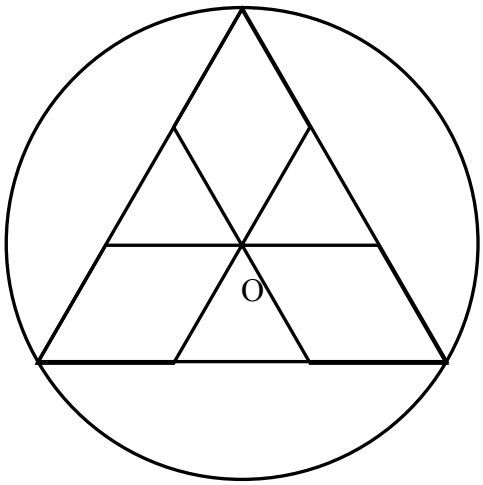
Intermediate Level – Solving Problems in Shape and Space (6985/2)

Answers and Marking Scheme

Question 1

(a)	(i) 4 (ii) 4	**B1** **B1**	
(b)	Area of outer circle $= \pi \times 5.6^2$ = 98.52034562 Area of inner circle $= \pi \times 0.8^2$ = 2.010619298	**M1** **A1**	Correct method for area of outer and/or inner circle. Area of outer and/or inner circle to any number of sf. Allow values from approximations for π: **Outer circle:** 98.53312 from 3.142 98.4704 from 3.14 98.56 from $\frac{22}{7}$ **Inner circle:** 2.01088 from 3.142 2.0096 from 3.14 2.011428571 from $\frac{22}{7}$
	Area of annulus = 96.50972632	**B1**√	**Alternatively:** Area of annulus $= \pi \times (5.6^2 - 0.8^2)$ M2 = 96.50972632 A1
	Area of each section = 96.50972632 ÷ 8 = 12.06371579		**Alternatively** ÷8 before subtracting
	= 12.1 (m^2)	**B1**√	Rounded to any number of significant figures. Allow omission of units but not incorrect units.
	TOTAL	**6**	

Question 2

(a)	Reflection in vertical line through *O*. Rotation about *O* through 120° anticlockwise	**B1** **B1** **B1** **B1**	Allow "mirror" or other implying reflection Or equivalent Allow "turn" or other implying rotation or 240° clockwise SC1 for full description of rotation in opposite direction
(b) **(i), (ii)**		**B1** **M1** **A1**√	Circle radius 5 cm Must see arcs Accuracy ± 0.1 cm SC1 Equilateral triangle without arcs
(iii), (iv)		**B1**√ **B1**√	Points marked on sides of the equilateral triangle 2.9 cm from the vertices. Allow ft for 3 equal segments on all sides of their triangle. Line drawn from centre of circle to each point. Must be to 6 points on triangle sides to attempt diagram
	TOTAL	**9**	

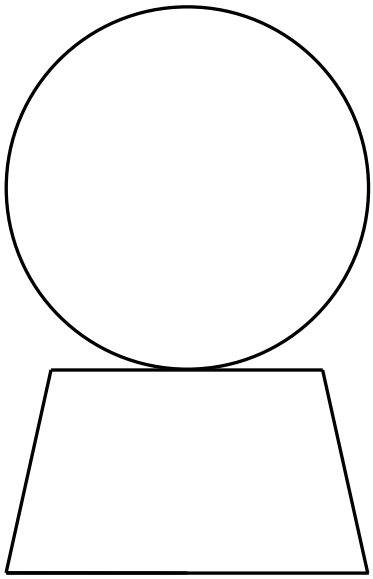
Question 3

(a)	kite	**B1**	
(b)(i)	$\angle CDE = \frac{360°}{8 \times 2} = 22.5°$	**B1** **B1**	Dividing 360° by 8 Dividing by 2 (may be implied by dividing by 16) Accept ∠ADC must be 45° for first B1 SC1 if refer to fitting together to make pattern
(ii)	$\tan 22.5° = \frac{CE}{3}$ $CE = 3 \times \tan 22.5°$ $= 3 \times 0.414213562$ $= 1.242640687$ $AC = 2 \times 1.242640687$ $= 2.485281374$ $= 2.49$ (m)	**M1** **M1** **A1** **B1√**	Correct use of tan Rearranged for *CE* Correctly rounded to 2 or more sf. Accept 2.5 (m) Allow omission of units. ft from their calculated value for CE (do not accept 2 × guess of 1.5)
	Area of $\Delta BCD = \frac{4.5 \times 1.242640687}{2}$ $= 2.795941546$ Area of $ABCD = 2 \times 2.795941546$ $= 5.591883092$ m^2 $= 5.59$ m^2	**M1** **A1√** **B1√**	ft from value found in (b)(ii) Correctly rounded to 2 or more sf. Must include units. Allow alternative methods involving areas of other triangles (eg *ABC* and *ADC*) Award M1, A1√ for the correct area of one or more triangles and B1√ for the final result.
	TOTAL	**10**	

Question 4

(a)(i)	Using Pythagoras $h^2 + 30^2 = 60^2$ $h = \sqrt{60^2 - 30^2}$ $= \sqrt{3600 - 900}$ $= \sqrt{2700}$ $h = 51.96152423$	**M1** **M1** **A1**	Correct use of Pythagoras Rearranged for h (dependent on first M1) Correctly rounded to any number of sf **Alternative Methods** Allow use of ΔABC or methods involving trigonometry eg $\sin 60° = \frac{h}{60}$ M1 $h = 60 \times \sin 60°$ M1 $h = 51.96152423$ A1
(ii)	Area of $DBCE = \frac{(120 + 60) \times 51.96152423}{2}$ = 4676.537181 = 4680 (cm^2)	**M1** **A1**√	Using value of h found in (a)(i) To any number of sf. Allow omission of units. Accept alternative methods using triangles or rectangle and triangles. Allow working in m^2.
(b)(i)	Area of cross section $= \frac{60 \times 51.96152423}{2}$ $= 1558.845727$ (or 1560) Volume $= 1558.845727 \times 210$ $= 327357.6026$	**M1** **A1**√ **B1**√	Using value of h found in (a)(i) To any number of sf. Allow omission of units.
(ii)	Volume $= 327357\ldots \div 1\,000\,000$ $= 0.327\ldots$ $= 0.33$ (m^3) to 2 sf	**M1** **A1**√	Using answer to (b)(i) Must be to 2 sf. Allow omission of units. Lose 2 marks in (b) if answer to (b)(ii) correct, but working done in metres
	TOTAL	**10**	

Question 5

(a)	As below 	**B1** **B1** **B1**	Accuracy ± 0.1 cm Parallel lines of length 3.6 cm and 4.8 cm a distance 2.7 cm apart Completed **symmetrical** trapezium Circle of diameter 4.8 cm, touching mid-point of top of trapezium.
(b)	Total height = 15 (cm) Ratio of height of small : large trophy = 10 : 15 Ratio of volume of small : large trophy = $2^3 : 3^3$	**B1** **M1** **A1**√	May be implied cube of height ratio
	TOTAL	**6**	

Question 6

	$\frac{4}{3}\pi r^3 = 126$ $r^3 = \frac{378}{4\pi}$ $r = \sqrt[3]{\frac{378}{4\pi}}$ $= \sqrt[3]{30.08028424}$ $= 3.11$ Radius = 3.11cm or 3.1cm	**M1** **M1** **M1** **A1**	Correct formula and substitution of 126 Rearrange for r^3 Cube root (Both dependent on previous M1) Award marks for rearrangement if done correctly before substitution of 126 Correctly rounded value. Allow omission of units.
	TOTAL	**4**	

Question 7

(a)	$\angle ARB = 78°$	**B1**	
(b)	$\frac{AR}{\sin 37°} = \frac{25}{\sin 78°}$	**M1**	Use of Sine Rule
	$AR = \frac{25 \times \sin 37°}{\sin 78°}$	**M1**	Rearranged for *AR* (dependent on first M1. May be before substitution of values)
	= 15.38149822	**A1**	
	= 15 metres	**A1**√	Must be rounded to nearest metre. Allow omission of units. Do not accept 15 metres if not supported by any working.
	TOTAL	**5**	
	TOTAL MARK FOR PAPER	**50**	