
MATHEMATICS (SYLLABUS D)**4024/22**

Paper 2

October/November 2019

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **7** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

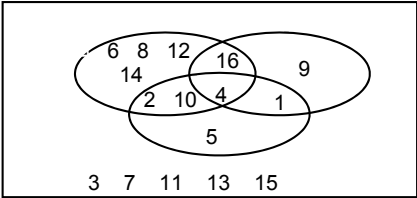
GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Abbreviations

cao	correct answer only
dep	dependent
FT	follow through after error
isw	ignore subsequent working
oe	or equivalent
SC	Special Case
nfw	not from wrong working
soi	seen or implied

Question	Answer	Marks	Partial Marks
1(a)	2356	2	M1 for product of any three of 15.20, $7\frac{3}{4}$, 5 and 4
1(b)	14	2	M1 for $\frac{25700 - 22102}{25700} [\times 100]$ or $\frac{22102}{25700} \times 100$ After 0 scored, SC1 for answer 86
1(c)	375	3	M2 for $\frac{465.75}{1.08 \times 1.15}$ oe or B1 for 1.08 or 1.15 oe seen After 0 scored, SC1 for answer 379 or 378.7[0] or 378.65 to 378.66
1(d)	601.75 or 601.76	3	M2 for $8500 \times \left(1 + \frac{3.1}{100}\right)^5$ oe or M1 for $8500 \times \left(1 + \frac{3.1}{100}\right)^k$ oe where $k > 1$
2(a)	$y = -1$ oe	1	
2(b)	Enlargement Scale factor -3 Centre (-3, 2)	3	B1 for each
2(c)	Correct transformation, vertices (5, -1), (6, -1), (6, -3), (5, -2)	2	B1 for three vertices correct or three correct pairs of coordinates soi
3(a)(i)	6 points plotted correctly	2	B1 for 3, 4 or 5 points plotted correctly
3(a)(ii)	4	1	
3(a)(iii)	Positive	1	
3(a)(iv)	Ruled line of best fit	1	
3(a)(v)	<i>Their</i> time for 800 m at 65 s for 400 m	1	Strict FT their straight line of best fit

Question	Answer	Marks	Partial Marks
3(b)(i)	$p+10+15+13+q = 50$ oe	1	
3(b)(ii)	$142.5p+147.5\times 10+152.5\times 15+157.5\times 13+162.5q=153.6\times 50$ oe simplified to $142.5p+162.5q = 1870$	2	B1 for $142.5p$, 147.5×10 , 152.5×15 , 157.5×13 and $162.5q$ seen or for 153.6×50 seen
3(b)(iii)	Correct method to eliminate one variable	M1	
	$[p =]4$ $[q =]8$	A2	A1 for one correct or B1 only for correct answers without algebraic method
4(a)	-1.8	1	
4(b)	Correct smooth curve	3	B2FT for 8 or 9 points correctly plotted or B1FT for 6 or 7 points correctly plotted
4(c)	Tangent drawn at (1, 4.8)	B1	Dep on <u>curve</u> drawn between (0, 3) and (2, 5.4)
	1.2 to 1.6	B1	Dep on close attempt at tangent
4(d)(i)	Ruled line through (-2, 5) to (2, 3) crossing curve three times	2	B1 for short or unruled line or for two correct coordinates soi
4(d)(ii)	-3.8 to -3.7 0.4 to 0.5 3.3 to 3.4	2	FT intersection of <i>their</i> line with <i>their</i> 'curve' B1FT for two correct
4(d)(iii)	$A = -25$ $B = 10$	3	B2 for one correct or M1 for $\frac{8-x}{2} = 3 + 2x - \frac{x^3}{5}$ oe
5(a)(i)	Correctly completed Venn diagram 	3	B2 for Venn diagram with one or two errors, omissions or repeats or for correct Venn diagram with 3, 7, 11, 13, 15 omitted or B1 for Venn diagram with three or four errors, omissions or repeats or for correct Venn diagram with 3, 7, 11, 13, 15 omitted and <u>one</u> other error, omission or repeat
5(a)(ii)	10	1	
5(a)(iii)	2, 4, 10	1	FT <i>their</i> Venn diagram
5(b)(i)	$\frac{1}{8}$ oe	1	

Question	Answer	Marks	Partial Marks
5(b)(ii)	$\frac{1}{40}$ oe	2	M1 for $\frac{k}{16} \times \frac{k-1}{15}$ or SC1 for answer $\frac{9}{256}$
6(a)	$\frac{3-5v}{v}$ oe final answer	2	M1 for correct first step $v(p+5) = 3$ or better
6(b)	$\frac{x^2-15}{(2x-5)(x-6)}$ or $\frac{x^2-15}{2x^2-17x+30}$ final answer	3	B1 for $x(x-6)+3(2x-5)$ oe soi B1 for denominator $(2x-5)(x-6)$ oe
6(c)	$[x=]-\frac{3}{10}$ oe	3	M1 for $4x+5 = 2(1-3x)$ soi M1 for isolating x terms: $4x+6x = 2-5$ or better
6(d)	$5x+15 = 4x^2-2x$	B1	
	$4x^2-7x-15[= 0]$ or $15+7x-4x^2[= 0]$	M1	
	$(4x+5)(x-3)[= 0]$	M1	or for $x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4 \times 4 \times (-15)}}{2 \times 4}$
	$[x=]-\frac{5}{4}$ oe, $[x=]3$	B1	
7(a)	[0]67.3 or [0]67.29...	4	B3 for [$\angle SPR =$] 25.3 or 25.29... or M2 for [$\sin SPR =$] $\frac{146 \sin 108}{325}$ or M1 for $\frac{146}{\sin SPR} = \frac{325}{\sin 108}$ oe AND M1 for <i>their</i> $SPR+42$
7(b)(i)	$[QR^2 =] 280^2+325^2-2 \times 280 \times 325 \times \cos 38$	M1	
	$= 201.5... [= 202]$	A2	A1 for [$QR^2 =$] 40 607.[...]
7(b)(ii)	2 minutes 12 seconds	3	M2 for $\frac{202}{1000 \times 5.5} \times 60 [\times 60]$ oe or M1 for $\frac{\text{figs } 202}{\text{figs } 5.5}$
8(a)	9300 or 9299 to 9301	3	M2 for $\frac{1}{3} \pi \times 16^2 \times 60 - \frac{1}{3} \pi \times 12^2 \times 45$ oe or M1 for $\frac{1}{3} \pi \times 16^2 \times 60$ or $\frac{1}{3} \pi \times 12^2 \times 45$

Question	Answer	Marks	Partial Marks
8(b)	$[c^2 =]12^2 + 45^2$	M1	
	$[c =]46.57\dots$	A1	
8(c)	1820 or 1816 to 1819.[0...]	4	B2 for $l = 62.09$ to 62.13 or M1 for $\sqrt{60^2 + 16^2}$ oe and M1 for $\pi \times 16 \times \text{their } 62.1 - \pi \times 12 \times 46.6$ [$+\pi \times 12^2$] If 0 scored, SC1 for $\pi \times 12^2$
9(a)(i)	$10 - x$ final answer	1	
9(a)(ii)	$12 - x$ final answer	1	
9(b)	$\frac{(10-x)(12-x)}{10 \times 12} = \frac{3}{4}$	M1	FT <i>their</i> algebraic <i>AR</i> and <i>AP</i>
	$120 - 12x - 10x + x^2$ seen	M1	FT Correct expansion of <i>their</i> brackets
	Correct expansion and rearrangement to $x^2 - 22x + 30 = 0$	A1	Dep on correct <i>AR</i> and <i>AP</i>
9(c)	$\frac{-(-22) \pm \sqrt{(-22)^2 - 4 \times 1 \times 30}}{2 \times 1}$	B2	B1 for $\sqrt{(-22)^2 - 4 \times 1 \times 30}$ or for $\frac{-(-22) \pm \sqrt{\text{their } 364}}{2 \times 1}$
	1.46, 20.54	B1	
9(d)	27.9 or 27.85 to 27.87...	2	M1 for use of <i>their</i> 1.46 to find an area e.g. $1.46(10 - 1.46)$, $1.46(12 - 1.46)$, 1.46^2 , etc.
10(a)	$AC = BD$ equal diameters AB is common $\angle ABC = \angle BAD = 90^\circ$ angle in semicircle Congruent RHS	3	B1 for correct pair of angles and one correct pair of sides or for two correct pairs of sides B1 for correct reasons for two pairs of sides/angles
10(b)(i)	124°	2	B1 for $\angle ADB$ or $\angle BCA = 62^\circ$ soi or $\angle AOD = 56^\circ$ soi or $\angle AOB = 124^\circ$ soi

Question	Answer	Marks	Partial Marks
10(b)(ii)	12.8 or 12.77 to 12.78	5	<p>M4 for</p> $4 \times 4 \tan\left(\frac{\text{their } 124}{2}\right) - \frac{\text{their } 124}{360} \times \pi \times 4^2$ <p>oe OR</p> <p>M1 for $DT = 4 \tan\left(\frac{\text{their } 124}{2}\right)$ oe or $OT = 4 \div \cos\left(\frac{\text{their } 124}{2}\right)$ oe</p> <p>M1 for [area kite =] $4 \times \text{their } DT$ oe or $\text{their } OT \times 4 \sin\left(\frac{\text{their } 124}{2}\right)$ oe</p> <p>M1 for [sector area =] $\frac{\text{their } 124}{360} \times \pi \times 4^2$ oe</p>