
MATHEMATICS (US)

0444/21

Paper 2 (Extended)

May/June 2018

MARK SCHEME

Maximum Mark: 70

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.

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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 |
| nfww | not from wrong working |
| soi | seen or implied |

| Question | Answer | Marks | Partial Marks |
|----------|--|-------|---|
| 1 | 23 or 29 | 1 | |
| 2 | 3.87×10^{-5} | 1 | |
| 3 | 4 | 1 | |
| 4 | 66 | 2 | B1 for 84 or -18 seen |
| 5 | 94 | 2 | B1 for ACB or PAB or $ABC = 43$ or M1 for $180 - 2 \times 43$ or for $\frac{1}{2}x = 90 - 43$ |
| 6 | 121 | 2 | M1 for $\sqrt{y} = 14 - 3$ or $3 - 14 = -\sqrt{y}$ or better |
| 7 | 10 | 2 | M1 for $[AC^2 =] 6^2 + 8^2$ |
| 8 | $7y - 23$ final answer | 2 | M1 for $12y - 18$ or $-5y - 5$ or B1 for $7y - k$ or $cy - 23$ $c \neq 0$ |
| 9 | -7 | 2 | B1 for 3^{-3} or 3^4 or 3^7 or 3^{-7} seen or SC1 for final answer 7 |
| 10 | 18 | 2 | M1 for $\frac{200 \times 1.5 \times 6}{100}$ oe |
| 11 | $6.45 \times 10^{p+1}$ | 2 | B1 for figs 645 or $0.35 \times 10^{p+1}$ or 61×10^p |
| 12 | $n < -4.4$ final answer | 2 | M1 for $8n - 3n < -5 - 17$ or better or $3n - 8n > 17 + 5$ or better |
| 13 | $\frac{x^8}{2}$ or $0.5x^8$ final answer | 2 | B1 for $\frac{x^8}{k}$ final answer or $\frac{x^k}{2}$ or $0.5x^k$ final answer |
| 14 | $7\sqrt{3}$ | 2 | B1 for $4\sqrt{3}$ or $3\sqrt{3}$ seen |

| Question | Answer | Marks | Partial Marks |
|----------|-------------------------------------|-----------|--|
| 15 | $\frac{3}{10}$ cao | 3 | M1 for $\frac{7}{4}$ or $\frac{k}{4} \times \frac{6}{35}$ where $k > 4$ A1 for $\frac{42}{140}$ or $\frac{21}{70}$ or $\frac{6}{20}$ |
| 16 | $[\sin =] 10 \times \frac{0.6}{12}$ | M2 | M1 for $\frac{12}{0.6} = \frac{10}{\sin x}$ oe or 0.5 |
| | 30 | A1 | |
| 17 | 9 | 3 | M1 for $y = k(x-1)^2$ M1 for $[y =] \text{their } k(7-1)^2$ OR M2 for $\frac{4}{(5-1)^2} = \frac{y}{(7-1)^2}$ oe |
| 18(a) | [Amplitude =] 3 [Period =] 180 | 2 | B1 for each SC1 for answers reversed |
| 18(b) | $9\sin(2x)$ | 1 | |
| 19 | $\frac{5x-17}{x-3}$ | 3 | B1 for common denominator $x-3$ oe B1 for $5(x-3) - 2$ or better |
| 20 | 840 | 3 | M2 for $\frac{672}{0.8}$ oe or M1 for recognising 672 as 80% |
| 21 | $[y =] \frac{1}{2}x + 2$ | 3 | B2 for gradient perpendicular = $\frac{1}{2}$ OR B1 for $kx + 2$ OR M1 for [gradient of AB =] $\frac{2-0}{0-1}$ oe or M1 for gradient = $\frac{-1}{\text{their gradient of } AB}$ |
| 22 | 16 nfww | 3 | M1 for $\frac{90}{360} \times \pi \times 2r = 4\pi$ oe or better M1 for $\frac{90}{360} \times \pi \times (\text{their } r)^2 [=k\pi]$ oe or $\frac{1}{4} (\text{their } r)^2$ |

| Question | Answer | Marks | Partial Marks |
|----------|----------------------|-------|--|
| 23 | 6 | 4 | <p>M3 for $\frac{4\sqrt{3}\sqrt{3}}{2}$</p> <p>M2 for $\frac{PQ}{4\sqrt{3}} = \frac{\sqrt{3}}{2}$</p> <p>M1 for $\frac{PQ}{4\sqrt{3}} = \cos 30$ or $\sin 60$</p> <p>or $[\cos 30 =] \frac{\sqrt{3}}{2}$ or $[\sin 60] = \frac{\sqrt{3}}{2}$</p> <p>ALT METHOD</p> <p>M3 for $\sqrt{(4\sqrt{3})^2 - (2\sqrt{3})^2}$</p> <p>M2 for $PQ^2 + (2\sqrt{3})^2 = (4\sqrt{3})^2$</p> <p>M1 for $RP = 2\sqrt{3}$ or $\cos 60 = \frac{1}{2}$ or $\sin 30 = \frac{1}{2}$</p> |
| 24(a) | 10 nfw | 2 | B1 for $UQ = 30$ or $LQ = 20$ clearly identified |
| 24(b) | 4 | 2 | B1 for 116 indicated |
| 25(a) | $\frac{8}{15}$ | 1 | |
| 25(b) | $\frac{168}{210}$ oe | 3 | <p>M2 for $1 - \frac{7}{15} \times \frac{6}{14}$ oe or $3\left(\frac{7 \times 8}{15 \times 14}\right)$ oe</p> <p>or M1 for $\frac{7}{15} \times \frac{6}{14}$ or $\frac{7}{15} \times \frac{8}{14}$ or $\frac{8}{15} \times \frac{7}{14}$ oe</p> |

| Question | Answer | Marks | Partial Marks |
|----------|---|-------|--|
| 26 | $y \geq 1.5$ oe $y \geq \frac{3}{4}x$ oe $y < -\frac{1}{2}x + 3$ oe | 4 | SC3 for $y > 1.5$ oe and $y > \frac{3}{4}x$ oe and $y \leq -\frac{1}{2}x + 3$ oe or B3 for any two correct inequalities or B1 for $y \geq 1.5$ oe and B2 for $y \geq \frac{3}{4}x$ oe or $y < -\frac{1}{2}x + 3$ oe or $y = \frac{3}{4}x$ oe and $y = -\frac{1}{2}x + 3$ oe or with incorrect inequality signs or B1 for $y = \frac{3}{4}x$ oe OR $y = -\frac{1}{2}x + 3$ oe or with incorrect inequality signs |
| 27(a) | 1.7 | 3 | M1 for Σfx allow one error or omission M1dep for $\frac{\textit{their } 34}{20}$ |
| 27(b) | 54 | 2 | M1 for $\frac{3}{20}$ or $\frac{360}{20}$ |