[C100/SQP328]

Mathematics
Higher
Paper 2
Specimen Marking Instructions
Example 2 based on 2004 Examination Paper
(for examinations from Diet 2008 onwards)

NATIONAL QUALIFICATIONS

Note: In the Specimen Marking Instructions the Marking Scheme indicates which marks awarded are strategy marks (ss), which marks awarded are processing marks (pd) and which marks awarded are interpretation and communication marks (ic).

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
1	**5 marks** •[1] ss: know to use eg scalar product •[2] pd: process scalar product •[3] pd: process length •[4] pd: process length •[5] pd: process angle	•[1] $\cos \mathrm{PQR} = \dfrac{\overrightarrow{\mathrm{QP}}.\overrightarrow{\mathrm{QR}}}{\lvert\overrightarrow{\mathrm{QP}}\rvert \times \lvert\overrightarrow{\mathrm{QR}}\rvert}$ stated or implied by •[5] •[2] $\overrightarrow{\mathrm{QP}}.\overrightarrow{\mathrm{QR}} = 6$ •[3] $\lvert\overrightarrow{\mathrm{QP}}\rvert = \sqrt{14}$ •[4] $\lvert\overrightarrow{\mathrm{QR}}\rvert = \sqrt{27}$ •[5] $\mathrm{P\hat{Q}R} = 72 \cdot 0°$ 5 *marks*

Alternative Method

•[1] $\cos \mathrm{P\hat{Q}R} = \dfrac{p^2 + r^2 - q^2}{2pr}$ stated or implied by •[5]

•[2] $q = \sqrt{29}$

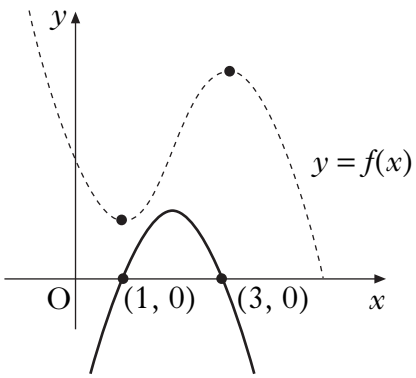
•[3] $r = \sqrt{14}$

•[4] $p = \sqrt{27}$

•[5] $\mathrm{P\hat{Q}R} = 72 \cdot 0°$

5 *marks*

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
2	**4 marks** •[1] ss: know/use discriminant •[2] ic: identify discriminant •[3] pd: simplify •[4] ic: complete proof	•[1] *know to show* $b^2 - 4ac \geq 0$ •[2] $p^2 - 4 \times 2 \times (-3)$ •[3] $p^2 + 24$ •[4] p^2 *is positive* *so* $\Delta \geq 0$ *and roots real* 4 *marks*
		Alternative Method •[1] $x = \dfrac{-p \pm \sqrt{(-p)^2 - 4\times 2\times (-3)}}{4}$ •[2] $x = \dfrac{-p \pm \sqrt{p^2 + 24}}{4}$ •[3] *we need* $p^2 + 24 \geq 0$ •[4] p^2 *is positive and so roots real* 4 *marks*
3	**(*a*) 5 marks** **(*b*) 2 marks** •[1] ss: know to differentiate •[2] pd: differentiate •[3] ss: set derivative = gradient •[4] pd: start to solve •[5] pd: process •[6] pd: process •[7] ic: state equation of tangent	•[1] $\dfrac{dy}{dx} =$ *stated or implied by* •[2] •[2] $12x - 3x^2$ •[3] $12x - 3x^2 = 12$ •[4] $3(x-2)^2 = 0$ •[5] $x = 2$ 5 *marks* •[6] $y = 16$ •[7] $y - 16 = 12(x-2)$ 2 *marks*

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
4	**(*a*) 4 marks** **(*b*) 3 marks** •[1] ss: expand •[2] ic: equate coefficients •[3] pd: solve for k •[4] pd: solve for a •[5] ss: use transformed function •[6] pd: solve trig equation for "$x - a$" •[7] pd: solve for x	•[1] $k\cos x\cos a + k\sin x\sin a$ *STATED EXPLICITLY* •[2] $k\cos a = 3,\ k\sin a = 5$ *STATED EXPLICITLY* •[3] $k = \sqrt{34}$ •[4] $a = 59$ 4 *marks* •[5] $\sqrt{34}\cos(x - 59)° = 4$ •[6] $x - 59$ = any one of $-46{\cdot}7,\ 47{\cdot}7,\ 313{\cdot}3$ •[7] $x = 12{\cdot}3$ 3 *marks*
5	**3 marks** •[1] ic: interpret stationary points •[2] ic: interpret between roots •[3] ic: know $f'(cubic) = parabola$  	a sketch with the following details •[1] *only two intercepts on the x-axis at 1 and 3* •[2] *function is +ve between the roots and −ve outwith* •[3] *a parabola (symmetrical about midpoint of x-intercepts), stated or implied by the accuracy of the diagram* 3 *marks* **Note** 1 The evidence for •[1] may be on a diagram or in a table or in words 2 For •[3], with the intercepts unknown, they must lie on the positive branch of the x-axis 3 For a parabola passing through (1, 1) and (3, 5) award **ONLY 1 MARK**

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
6	**(*a*) 4 marks** **(*b*) 5 marks** **(*c*) 2 marks** •[1] ic: interpret circle equation •[2] ic: find gradient •[3] ss: know/find perpendicular gradient •[4] pd: complete proof •[5] pd: start solving process •[6] ss: know/substitute •[7] pd: arrange in standard form •[8] ss: know how to justify tangency •[9] ic: complete proof •[10] ic: interpret solution from (*b*) •[11] pd: process distance formula	•[1] $A(6, 1)$ •[2] $m_{AP} = 2$ *STATED EXPLICITLY* •[3] $m_{PT} = -\frac{1}{2}$ •[4] $y + 1 = -\frac{1}{2}(x - 5)$ *and complete* 4 *marks* •[5] $x = 3 - 2y$ •[6] $(3 - 2y)^2 + y^2 + 10(3 - 2y) + 2y + 6 = 0$ •[7] $5y^2 - 30y + 45 = 0$ •[8] *solve and get double root* $\Rightarrow$ *tangent* •[9] $5(y - 3)^2 = 0$ 5 *marks* •[10] $Q = (-3, 3)$ •[11] $PQ = \sqrt{80}$ 2 *marks*
		Alternative method for •[1] to •[4] •[1] $(3 - 2y)^2 + y^2 - 12(3 - 2y) - 2y + 32 = 0$ •[2] $5(y + 1)^2 = 0$ •[3] *double root* $\Rightarrow$ *tangent* •[4] $x = 3 - 2y = 3 - 2 \times (-1) = 5$ 4 *marks*

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
7	**(*a*) 3 marks** **(*b*) 5 marks** •[1] ss: use area facts •[2] ss: use volume facts •[3] ic: complete proof •[4] pd: arrange in standard form •[5] pd: differentiate •[6] ss: set derivative to zero •[7] pd: process •[8] ic: justification eg a nature table	•[1] $A = 2x^2 + 2xh + 4xh = 12$ •[2] $V = 2x \times x \times h$ •[3] $V = 2x \times \frac{12-2x^2}{6} = \text{and complete}$ 3 *marks* •[4] $V = 4x - \frac{2}{3}x^3$ •[5] $\frac{dV}{dx} = 4 - 2x^2$ •[6] $\frac{dV}{dx} = 0$ *STATED EXPLICITLY* •[7] $x = \sqrt{2}$ •[8] x | $< \sqrt{2}$ | $\sqrt{2}$ | $> \sqrt{2}$ $\frac{dV}{dx}$ | $+ve$ | 0 | $-ve$ tgt | / | − | \ max 5 *marks*

Alternative method for •[1], •[2] and •[3]

•[1] $2x^2 + 2xh + 4xh = 12$
•[2] $h = \frac{12-2x^2}{6}$
•[3] $V = 2x \times x \times \frac{12-2x^2}{6x} = \text{and complete}$
3 *marks*

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
8	**(*a*) 3 marks** **(*b*) 4 marks** •[1] ss: substitute •[2] pd: change the subject •[3] pd: process exponential power •[4] ic: interpret half life •[5] pd: process •[6] ss: switch to logarithmic form •[7] pd: solve logarithmic equation	•[1] $600 = A_0 e^{-0\cdot002\times1000}$ •[2] $A_0 = \dfrac{600}{e^{-0\cdot002\times1000}}$ •[3] 4433 3 *marks* •[4] $\frac{1}{2}A_0 = A_0 e^{-0\cdot002t}$ •[5] $0\cdot5 = e^{-0\cdot002t}$ •[6] $-0\cdot002t = \ln 0\cdot5$ •[7] $t = 347$ years 4 *marks*
		Alternative method for (*a*) •[1] $600 = A_0 e^{-0\cdot002\times1000}$ •[2] $\ln A_0 = \ln 600 - \ln e^{-0\cdot002\times1000}$ •[3] $A_0 = 4433$ 3 *marks*

Qu	The Primary Method m/s is based on the following generic m/s. THIS GENERIC M/S MAY BE USED AS AN EQUIVALENCE GUIDE BUT ONLY WHERE A CANDIDATE DOES NOT USE THE PRIMARY METHOD OR ANY ALTERNATIVE METHOD SHOWN IN DETAIL IN THE MARKING SCHEME.	Primary Method: Give 1 mark for each •
9	**8 marks** •[1] ss: find intersections •[2] pd: process quadratic to solution •[3] ss: decide on appropriate areas •[4] ss: know to integrate •[5] ic: state limits •[6] pd: integrate •[7] pd: evaluate using limits •[8] pd: evaluate area	•[1] $2x - \frac{1}{2}x^2 = 1 \cdot 5$ •[2] $x = 1,\ x = 3$ •[3] "*split area up*" *stated or implied by* •[4] •[4] $\int \left(2x - \frac{1}{2}x^2 - \frac{3}{2}\right)dx$ •[5] $\int_1^3 \ldots dx$ •[6] $\left[x^2 - \frac{1}{6}x^3 - \frac{3}{2}x\right]_1^3$ •[7] $\left(3^2 - \frac{1}{6}.3^3 - \frac{3}{2}.3\right) - \left(1^2 - \frac{1}{6}.1^3 - \frac{3}{2}.1\right)$ •[8] $\frac{2}{3}$ 8 *marks*

[*END OF SPECIMEN MARKING INSTRUCTIONS*]