qu		Mk	Code	cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.01		8	C8,C9	cn	08507	3	4	1	8				8		

2.01

Find the coordinates of the turning points of the curve with equation $y = x^3 - 3x^2 - 9x + 12$ and determine their nature. 8

The primary method m.s is based on the following generic m.s.

This generic marking scheme 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.

$\bullet^1$	ss	know to differentiate
$\bullet^2$	pd	differentiate
$\bullet^3$	ss	set derivative to zero
$\bullet^4$	pd	factorise
$\bullet^5$	pd	solve for x
$\bullet^6$	pd	evaluate y-coordinates
$\bullet^7$	ss	know to, and justify turning points
$\bullet^8$	ic	interpret result

Primary Method : Give 1 mark for each •

$\bullet^1$ $\frac{dy}{dx} = \ldots(1 \textit{ term correct})$

$\bullet^2$ $3x^2 - 6x - 9$

$\bullet^3$ $\frac{dy}{dx} = 0$

$\bullet^4$ $3(x+1)(x-3)$

	$\bullet^5$	$\bullet^6$
$\bullet^5$	$x = -1$	$x = 3$
$\bullet^6$	$y = 17$	$y = -15$

		$\bullet^7$				$\bullet^8$	
$\bullet^7$ x	…	-1	…	…	3	…
$\frac{dy}{dx}$	$+$	0	$-$	$-$	0	$+$
$\bullet^8$		max			min	

Notes

1. The "=0" (shown at $\bullet^3$) ***must*** occur at least once before $\bullet^5$.
2. $\bullet^4$ is only available as a consequence of solving $\frac{dy}{dx} = 0$.
3. The nature table must reflect previous working from $\bullet^4$.
4. For $\bullet^4$, accept $(x+1)(x-3)$.
5. The use of the 2nd derivative is an acceptable strategy.
6. As shown in the Primary Method, ($\bullet^5$ and $\bullet^6$) and ($\bullet^7$ and $\bullet^8$) can be marked horizontally or vertically.
7. $\bullet^1$, $\bullet^2$ and $\bullet^3$ are the only marks available to candidates who solve $3x^2 - 6x = 9$.

Notes cont

8. If $\bullet^7$ is not awarded, $\bullet^8$ is only available as follow-through if there is clear evidence of where the signs at the $\bullet^7$ stage have been obtained.
9. For $\bullet^7$ and $\bullet^8$

   The completed nature table is worth 2 marks if correct.

   If the labels "x" and/or "$\frac{dy}{dx}$" are missing from an otherwise correct table then **award 1 mark.**

   If the labels "x" and/or "$\frac{dy}{dx}$" are missing from a table where either $\bullet^7$ or $\bullet^8$ (vertically) would otherwise have been awarded, then **award 0 marks.**

Alternatives

This would be fairly common:

$\bullet^1$ √ $\frac{dy}{dx} = \ldots(1 \textit{ term correct})$

$\bullet^2$ √ $3x^2 - 6x - 9$

$\bullet^3$, $\bullet^4$ √√ $(3x-9)(x+1) = 0$

or $(3x+3)(x-3) = 0$

Min. requirements of a nature table

x	…	-1	…
$\frac{dy}{dx}$	$+$	0	$-$
		max	

Preferred nature table

x	…	-1	…
$\frac{dy}{dx}$	$+$	0	$-$
	/	—	\
		max	

qu		Mk	Code	cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.02	a	3	A4	cn	09011	1		2	3				3		
	b	3	C1	cn		2	1		3				3		

2.02

Functions f and g are given by $f(x) = 3x + 1$ and $g(x) = x^2 - 2$.

(a) (i) Find $p(x)$ where $p(x) = f\left(g(x)\right)$

(ii) Find $q(x)$ where $q(x) = g\left(f(x)\right)$. 3

(b) Solve $p'(x) = q'(x)$. 3

The primary method m.s is based on the following generic m.s.

This generic marking scheme 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.

•1	ss	substitute for $g(x)$ in $f(x)$
•2	ic	complete
•3	ic	sub. and complete for $q(x)$
•4	ss	simplify
•5	pd	differentiate
•6	pd	solve

Primary Method : Give 1 mark for each •

•1 $f(x^2 - 2)$ **s / i by •2**

•2 $3(x^2 - 2) + 1$

•3 $(3x + 1)^2 - 2$

	•4	•5
•4	$3x^2 - 5$	$9x^2 + 6x - 1$
•5	$6x$	$18x + 6$ *or equiv.*

s / i by •5

•6 $x = -\frac{1}{2}$

Notes

1. In (a)
   2 marks are available for finding either $f\left(g(x)\right)$ or $g\left(f(x)\right)$ and 1 mark for finding the other.
2. In (b)
   candidates who start by equating $p(x)$ and $q(x)$ and then differentiate may earn •4 and •6 only.

Common Errors

1

$p(x)$ and $q(x)$ switched round:

X	•1	$p(x) = g(3x+1)$
X √	•2	$p(x) = (3x+1)^2 - 2$
X √	•3	$q(x) = \ldots\ldots = 3(x^2 - 2) + 1$

2

Candidates who find $f(f(x))$ and $g(g(x))$ can earn no marks in (a) but

X √	•4	$9x + 4$ *and* $x^4 - 4x^2 + 2$
X √	•5	$9 = 4x^3 - 8x$
XX	•6	*not available*

3

X	•4	$3x^2 - 1$ *and* $9x^2 + 6x - 1$
X √	•5	$6x$ *and* $18x + 6$
X √	•6	$x = -\frac{1}{2}$

Alternative for •1 *to* •3 :

•1 $f\left(g(x)\right) = 3 \times g(x) + 1$

•2 $f\left(g(x)\right) = 3\left(x^2 - 2\right) + 1$

$g\left(f(x)\right) = \left(f(x)\right)^2 - 2$

•3 $g\left(f(x)\right) = (3x+1)^2 - 2$

qu		Mk	Code	cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.03	a	4	A21	cn	09008	1	1	2	4					4	
	b	5	A32	cn		2	1	2		5					5

2.03

(*a*) (i) Show that $x = 1$ is a root of $x^3 + 8x^2 + 11x - 20 = 0$.

(ii) Hence factorise $x^3 + 8x^2 + 11x - 20$ fully. 4

(*b*) Solve $\log_2(x+3) + \log_2(x^2 + 5x - 4) = 3$. 5

The primary method m.s is based on the following generic m.s.
This generic marking scheme 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.

•1	ss	know and use $f(a) = 0 \Leftrightarrow a$ is a root
•2	ic	start to find quadratic factor
•3	ic	complete quadratic factor
•4	pd	factorise fully
•5	ss	use log laws
•6	ss	know to & convert to exponential form
•7	ic	write cubic in standard form
•8	pd	solve cubic
•9	ic	interpret valid solution

Primary Method : Give 1 mark for each •

•1	$f(1) = 1 + 8 + 11 - 20 = 0$ *so* $x = 1$ *is a root*	**See Note 1**
•2	$(x-1)(x^2 \ldots\ldots\ldots)$	
•3	$(x^2 + 9x + 20)$	
•4	$(x-1)(x+4)(x+5)$	**Stated explicitly**
•5	$\log_2\left((x+3)(x^2+5x-4)\right)$	**s / i by •6**
•6	$(x+3)(x^2+5x-4) = 2^3$	
•7	$x^3 + 8x^2 + 11x - 20 = 0$	
•8	$x = 1$ *or* $x = -4$ *or* $x = -5$	**Stated explicitly here**
•9	$x = 1$ *only*	

Notes

1. For candidates evaluating the function, some acknowledgement of the resulting zero must be shown in order to gain •1.
2. For candidates using synthetic division (shown in Alt. box), some acknowledgement of the resulting zero must be shown in order to gain •2.
3. In option 2 the "zero" has been highlighted by underlining. This can also appear in colour, bold or boxed.
   Some acknowledgement of the resulting zero must be shown in order to gain •1 as indicated in each option.

Common Errors

1

•5 X	$\log_2 \dfrac{x^2+5x-4}{x+3} = 3$
•6 X ✓	$\dfrac{x^2+5x-4}{x+3} = 2^3$
•7 X	$x^2 - 3x - 28 = 0$
•8 X	$x = 7$ *or* -4
•9 X ✓	$x = 7$ **ONLY**

Options

Alternative for •1 to •2.

1

•1

$$\begin{array}{r|rrrr} & 1 & 8 & 11 & -20 \\ 1 & & 1 & & \\ \hline & 1 & 9 & & \end{array}$$

•2

$$\begin{array}{r|rrrr} & 1 & 8 & 11 & -20 \\ 1 & & 1 & 9 & 20 \\ \hline & 1 & 9 & 20 & 0 \end{array}$$

rem. = 0
so $x = 1$ *is root*
see note 2

2

•1

$$\begin{array}{r|rrrr} & 1 & 8 & 11 & -20 \\ 1 & & 1 & & \\ \hline & 1 & 9 & & \end{array}$$

•2

$$\begin{array}{r|rrrr} & 1 & 8 & 11 & -20 \\ 1 & & 1 & 9 & 20 \\ \hline & 1 & 9 & 20 & \underline{\underline{0}} \end{array}$$

so $x = 1$ *is root*
see note 3

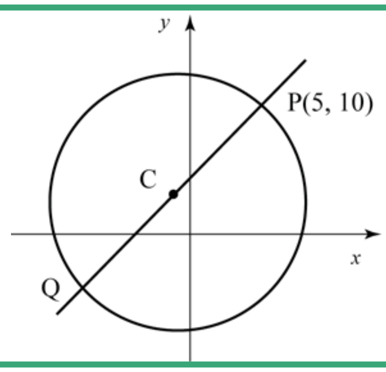
qu		Mk	Code	Cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.04	a	1	A6	cn	08026		1		1				1		
	b	5	G11	cn		2		3	5					5	
	c	4	G15	nc		1	1	2			4			4	

2.04

(*a*) Show that the point P(5, 10) lies on circle C_1 with equation $(x+1)^2+(y-2)^2=100$. 1

(*b*) PQ is a diameter of this circle as shown in the diagram. Find the equation of the tangent at Q. 5

(*c*) Two circles, C_2 and C_3, touch circle C_1 at Q. The radius of each of these circles is twice the radius of circle C_1. Find the equations of circles C_2 and C_3. 4



The primary method m.s is based on the following generic m.s.
This generic marking scheme may be used as an equivalence g
but only where a candidate does not use the primary method or
alternative method shown in detail in the marking scheme.

•1	pd	substitute
•2	ic	find centre
•3	ss	use mid-point result for Q
•4	ss	know to, and find gradient of radi
•5	ic	find gradient of tangent
•6	ic	state equation of tangent
•7	ic	state radius
•8	ss	know how to find centre
•9	ic	state equation of one circle
•10	ic	state equation of the other circle

Primary Method : Give 1 mark for each •

•1	$(5+1)^2+(10-2)^2=100$	
•2	$centre=(-1,2)$	
•3	$Q=(-7,-6)$	**(no evidence requ.)**
•4	$m_{rad}=\frac{8}{6}$	
•5	$m_{tgt}=-\frac{3}{4}$	**s / i by •6**
•6	$y-(-6)=-\frac{3}{4}(x-(-7))$	
•7	$radius=20$	**s / i by •9 or •10**
•8	$centre=(5,10)$	**s / i by •9**
•9	$(x-5)^2+(y-10)^2=400$	
•10	$(x+19)^2+(y+22)^2=400$	

Notes

1. In (a), candidates may choose to show that distance CP = the radius. Markers should note that evidence for •2, which is in (b), may appear in (a).
2. The minimum requirement for •1 is as shown in the Primary Method.
3. •6 is only available as a conseqence of attempting to find a perp. gradient.
4. For candidates who choose a Q *ex nihilo*, •6 is only available if the chosen Q lies in the 3rd quadrant.

Notes cont

5. •9 and/or •10 are only available as follow-through if a centre with numerical coordinates has been stated explicitly.
6. •10 is not available as a follow-through; it must be correct.

Alternative for •8, •9 and •10

•8	$centre=(-19,-22)$	**s / i by •9**
•9	$(x+19)^2+(y+22)^2=400$	
•10	$(x-5)^2+(y-10)^2=400$	

qu		Mk	Code	Cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.05	a	1	T4	cn	09026			1	1				1		
	b	5	T6	cr		1	3	1	5					5	
	c	6	C17,23	cr		1	3	2		6				6	

2.05

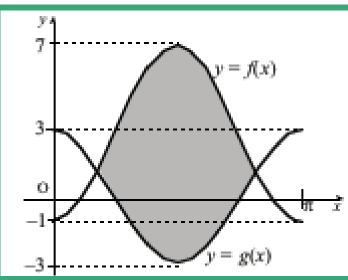
The graphs of $y = f(x)$ and $y = g(x)$ are shown in the diagram.

$f(x) = -4\cos(2x) + 3$ and $g(x)$ is of the form $g(x) = m\cos(nx)$.

(*a*) Write down the values of *m* and *n*. 1

(*b*) Find, correct to 1 decimal place, the coordinates of the points of intersection of the two graphs in the interval shown. 5

(*c*) Calculate the shaded area. 6



The primary method m.s is based on the following generic m.s.

This generic marking scheme 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.

- •1 ic interprets graph
- •2 ss knows how to find intersection
- •3 pd starts to solve
- •4 pd finds x-coordinate in the 1st quadrant
- •5 pd finds x-coordinate in the 2nd quadrant
- •6 pd finds y-coordinates
- •7 ss knows how to find area
- •8 ic states limits
- •9 pd integrate
- •10 pd integrate
- •11 ic substitute limits
- •12 pd evaluate area

Primary Method : Give 1 mark for each •

- •1 $m = 3$ *and* $n = 2$
- •2 $3\cos 2x = -4\cos 2x + 3$
- •3 $\cos 2x = \frac{3}{7}$
- •4 $x = 0.6$
- •5 $x = 2.6$
- •6 $y = 1.3,\ 1.3$
- •7 $\int \left(-4\cos 2x + 3 - 3\cos 2x\right)\ dx$
- •8 $\int_{0.6}^{2.6}$
- •9 $"-7\sin 2x"$
- •10 $3x - \frac{7}{2}\sin 2x$
- •11 $(3\times 2.6 - \frac{7}{2}\sin 5.2) - (3\times 0.6 - \frac{7}{2}\sin 1.2)$
- •12 12.4

Continued on next page

Continued on next page

Question 2.05 cont.

Notes 1

1. Answers which are not rounded should be treated as "bad form" and not penalised.
2. If $n = 1$ from (a), then in (b) the follow-through solution is 0.697 and 5.586.
   $\bullet^{5}$ is not available in (b)
   and $\bullet^{8}$ is not available in (c).
3. If $n = 3$ from (a), then in (b) only $\bullet^{2}$ is available.
4. At $\bullet^{5}$:
   $x = 2.5$ can only come from calculating $\pi - 0.6$. For this to be accepted, candidates must state that it comes from symmetry of the graph.
5. For $\bullet^{6}$
   Acceptable values of y will lie in the range 1.1 to 1.6
   (due to early rounding !!)
6. Values of x used for the limits must lie between 0 and π,
   i.e $0 < \text{limits} < \pi$, else $\bullet^{8}$ is lost.
7. $\bullet^{8}, \bullet^{11}$ and $\bullet^{12}$ are not available to candidates who use -3 and 7 as the limits.
8. Candidates must deal appropriately with any extraneous negative signs which may appear before $\bullet^{12}$ can be awarded.
   It is considered inappropriate to write .... = −12.4 = 12.4

Common Errors

1. For candidates who work in degrees throughout this question, the following marks are available:

In (b)		In (c)	
$\bullet^{2}$	√	$\bullet^{7}$	√
$\bullet^{3}$	√	$\bullet^{8}$	X
$\bullet^{4}$	X	$\bullet^{9}$	X
$\bullet^{5}$	X √	$\bullet^{10}$	X √
$\bullet^{6}$	√	$\bullet^{11}$	X
		$\bullet^{12}$	X

2. In (c) candidates who deal with $f(x)$ and $g(x)$ separately and **add** can only earn at most
   - $\bullet^{8}$ correct limits
   - $\bullet^{9}$ for correct integral of $f(x)$
   - $\bullet^{10}$ for correct integral of $g(x)$
   - $\bullet^{11}$ for correct substitution.

Alternative for $\bullet^{3}, \bullet^{4}, \bullet^{5}$

Option 1

$\bullet^{3}$ $\cos^2 x = \frac{10}{14}$

$\bullet^{4}$ $\cos x = \sqrt{\frac{10}{14}}$, $\quad \cos x = -\sqrt{\frac{10}{14}}$

$\bullet^{5}$ $x = 0.6 \qquad x = 2.6$

Option 2

$\bullet^{3}$ $\cos^2 x = \frac{10}{14}$

$\bullet^{4}$ $\cos x = \sqrt{\frac{10}{14}}$ *and* $x = 0.6$

$\bullet^{5}$ $\cos x = -\sqrt{\frac{10}{14}}$ *and* $x = 2.6$

Option 3

$\bullet^{3}$ $\sin^2 x = \frac{4}{14}$

$\bullet^{4}$ $\sin x = \sqrt{\frac{4}{14}}$

$\bullet^{5}$ $x = 0.6, \quad x = 2.6$

Alternative for $\bullet^{9}, \bullet^{10}$

$\bullet^{9}$ $-4\sin 2x - 3\sin 2x$

$\bullet^{10}$ $3x - \frac{4}{2}\sin 2x - \frac{3}{2}\sin 2x$

qu		Mk	Code	cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.06	a	2	A30,34	cr	08532		1	1		2					2
	b	3	A30,34	cr		1	1	1			3				3

2.06

The size of the human population, N, can be modelled using the equation $N = N_0 e^{rt}$ where N_0 is the population in 2006, t is the time in years since 2006, and r is the annual rate of increase in the population.

(*a*) In 2006 the population of the United Kingdom was approximately 61 million, with an annual rate of increase of 1·6%. Assuming this growth rate remains constant, what would be the population in 2020 ? **2**

(*b*) In 2006 the population of Scotland was approximately 5·1 million, with an annual rate of increase of 0·43%. Assuming this growth rate remains constant, how long would it take for Scotland's population to double in size ? **3**

The primary method m.s is based on the following generic m.s.

This generic marking scheme 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.

- •1 ic substitute into equation
- •2 pd evaluate exponential expression
- •3 ic interpret info and substitute
- •4 ss convert expo. equ. to log. equ.
- •5 pd process

Primary Method : Give 1 mark for each •

- •1 $61e^{0.016\times14}$
- •2 76 million *or equiv.*
- •3 $10.2 = 5.1e^{0.0043t}$
- •4 $0.0043t = \ln 2$
- •5 $t = 161.2$ years

Notes

1. For •2, do not accept 76. Accept any answer which rounds to 76 million and was obtained from legitimate sources.
2. •5 is for a rounded up answer or implying a rounded-up answer. Acceptable answers would include 162 and 161.2 but not 161.
3. **Cave** Beware of poor imitations which yield results similar/same to that given in the paradigm, e.g. compound percentage *or* recurrence relations. These can receive no credit but see Common Error 2 for exception.

Common Errors

1 Candidates who misread the rate of increase:

- •1 X $61e^{1.6\times14}$
- •2 $X\ \surd$ 3.26×10^{11} *million*
- •3 $X\ \surd$ $10.2 = 5.1e^{0.43t}$
- •4 $X\ \surd$ $0.43t = \ln 2$
- •5 $X\ \surd$ $t = 1.612$

2

- •1 X 61×1.016^{14}
- •2 X 76 *million*
- •3 X $10.2 = 5.1\times1.0043^t$
- •4 $X\ \surd$ $t\ln 1.0043 = \ln 2$
- •5 $X\ \surd$ $t = 162$

i.e. award 2 marks

Options

1

- •1 $61000000e^{0.016\times14}$
- •2 76000000

2

- •1 $(61 \text{ million})\times e^{0.016\times14}$
- •2 76 million

3

- •1 $61000000e^{0.224}$
- •2 76 million

4

- •1 $(61 \text{ million})\times e^{0.224}$
- •2 76000000

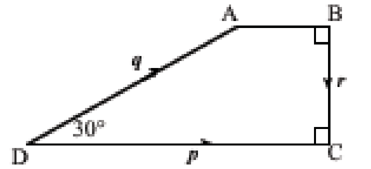
qu		Mk	Code	cal	Source	ss	pd	ic	C	B	A		U1	U2	U3
2.07	a	6	G29,26	cn	09031	1	2	3		6					6
	b	4	G21,30	cr		1	1	2		2	2				4

2.07

Vectors $\boldsymbol{p}$, $\boldsymbol{q}$ and $\boldsymbol{r}$ are represented on the diagram shown where angle ADC = 30°. It is also given that $|\boldsymbol{p}| = 4$ and $|\boldsymbol{q}| = 3$.

(*a*) Evaluate $\boldsymbol{p}.(\boldsymbol{q} + \boldsymbol{r})$ and $\boldsymbol{r}.(\boldsymbol{p} - \boldsymbol{q})$. 6

(*b*) Find $|\boldsymbol{q} + \boldsymbol{r}|$ and $|\boldsymbol{p} - \boldsymbol{q}|$. 4



The primary method m.s is based on the following generic m.s.

This generic marking scheme 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.

•1	ss	use distributive law
•2	ic	interpret scalar product
•3	pd	processing scalar product
•4	ic	interpret perpendicularity
•5	ic	interpret scalar product
•6	pd	complete processing
•7	ic	interpret vectors on a 2-D diagram
•8	pd	evaluate magnitude of vector sum
•9	ic	interpret vectors on a 2-D diagram
•10	pd	evaluate magnitude of vector difference

Primary Method : Give 1 mark for each •

•1	$\boldsymbol{p}.\boldsymbol{q} + \boldsymbol{p}.\boldsymbol{r}$	**s / i by (•2 and •4)**
•2	$4 \times 3\cos 30°$	**s / i by •3**
•3	$6\sqrt{3}$ (10.4)	
•4	$\boldsymbol{p}.\boldsymbol{r} = 0$	**explicitly stated**
•5	$-|\boldsymbol{r}| \times 3\cos 120°$	
•6	$r = \frac{3}{2}$ *and* ... $\frac{9}{4}$	
•7	$\boldsymbol{q} + \boldsymbol{r} \equiv$ from D to the projection of A onto DC	
•8	$|\boldsymbol{q} + \boldsymbol{r}| = \frac{3\sqrt{3}}{2}$	
•9	$\boldsymbol{p} - \boldsymbol{q} \equiv \overrightarrow{AC}$	
•10	$|\boldsymbol{p} - \boldsymbol{q}| = \sqrt{\left(4 - \frac{3\sqrt{3}}{2}\right)^2 + \left(\frac{3}{2}\right)^2}$ (2.05)	

Notes

1. $\boldsymbol{p}.(\boldsymbol{q} + \boldsymbol{r}) = pq + pr$ gains no marks unless the "vectors" are treated correctly further on. In this case treat this as bad form.
2. The evidence for •7 and •9 will likely appear in a diagram with the vectors $\boldsymbol{q} + \boldsymbol{r}$ and $\boldsymbol{p} - \boldsymbol{q}$ **clearly marked.**

Common Errors

1 For •1 to •4

$\boldsymbol{p}.(\boldsymbol{q} + \boldsymbol{r}) = \boldsymbol{p}.\boldsymbol{q} + \boldsymbol{p}.\boldsymbol{r}$

$= 4 \times 3 + 4 \times \frac{3}{2}$

$= 18$

can only be awarded •1.

Alternatives 1

1 For •7 and •8 :

•7 √ $\boldsymbol{p}.(\boldsymbol{q} + \boldsymbol{r}) = |\boldsymbol{p}|\ |\boldsymbol{q} + \boldsymbol{r}|\cos 0$

$6\sqrt{3} \quad = 4|\boldsymbol{q} + \boldsymbol{r}| \times 1$

•8 √ $|\boldsymbol{q} + \boldsymbol{r}| = \frac{6\sqrt{3}}{4} = \frac{3\sqrt{3}}{2}$

2 For •9, •10 :

Using right-angled Δ ABC

•9 $\overrightarrow{AC} = \boldsymbol{p} - \boldsymbol{q}$,

and $|\overrightarrow{AB}| = 4 - \frac{3\sqrt{3}}{2}$, $|\overrightarrow{BC}| = \frac{3}{2}$

and $A\hat{C}B = 43.06°$

•10 *use* $\boldsymbol{r}.(\boldsymbol{p} - \boldsymbol{q}) = \frac{9}{4}$

to get $|\boldsymbol{p} - \boldsymbol{q}| = 2.05$

Alternatives 2

3

For •7, •8, •9, •10 :

Set up a coord system with origin at D

•7 $C = (4,0), A = \left(\frac{3\sqrt{3}}{2}, \frac{3}{2}\right), B = \left(4, \frac{3}{2}\right)$

•8 $\boldsymbol{p} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}, \boldsymbol{q} = \begin{pmatrix} \frac{3\sqrt{3}}{2} \\ \frac{3}{2} \end{pmatrix}, \boldsymbol{r} = \begin{pmatrix} 0 \\ -\frac{3}{2} \end{pmatrix}$

•9 $\boldsymbol{q} + \boldsymbol{r} = \begin{pmatrix} \frac{3\sqrt{3}}{2} \\ 0 \end{pmatrix}$ *and* $|\boldsymbol{q} + \boldsymbol{r}| = 2.60$

•10 $\boldsymbol{p} - \boldsymbol{q} = \begin{pmatrix} 4 - \frac{3\sqrt{3}}{2} \\ -\frac{3}{2} \end{pmatrix}$ *and* $|\boldsymbol{p} - \boldsymbol{q}| = 2.05$

Marks : May 2009

Centre/group																
cand no.																totals
21a	1						21a	1						21a	1	
21b	3						21b	3						21b	3	
21c	4						21c	4						21c	4	
22a	4						22a	4						22a	4	
22b	4						22b	4						22b	4	
23a	2						23a	2						23a	2	
23b	3						23b	3						23b	3	
24a	3						24a	3						24a	3	
24b	2						24b	2						24b	2	
24c	4						24c	4						24c	4	
1	8						1	8						1	8	
2a	3						2a	3						2a	3	
2b	3						2b	3						2b	3	
3a	4						3a	4						3a	4	
3b	5						3b	5						3b	5	
4a	1						4a	1						4a	1	
4b	5						4b	5						4b	5	
4c	4						4c	4						4c	4	
5a	1						5a	1						5a	1	
5b	5						5b	5						5b	5	
5c	6						5c	6						5c	6	
6a	2						6a	2						6a	2	
6b	3						6b	3						6b	3	
7a	6						7a	6						7a	6	
7b	4						7b	4						7b	4	
	totals							totals								

Centre/group																
cand.no																totals
21a	1						21a	1						21a	1	
21b	3						21b	3						21b	3	
21c	4						21c	4						21c	4	
22a	4						22a	4						22a	4	
22b	4						22b	4						22b	4	
23a	2						23a	2						23a	2	
23b	3						23b	3						23b	3	
24a	3						24a	3						24a	3	
24b	2						24b	2						24b	2	
24c	4						24c	4						24c	4	
1	8						1	8						1	8	
2a	3						2a	3						2a	3	
2b	3						2b	3						2b	3	
3a	4						3a	4						3a	4	
3b	5						3b	5						3b	5	
4a	1						4a	1						4a	1	
4b	5						4b	5						4b	5	
4c	4						4c	4						4c	4	
5a	1						5a	1						5a	1	
5b	5						5b	5						5b	5	
5c	6						5c	6						5c	6	
6a	2						6a	2						6a	2	
6b	3						6b	3						6b	3	
7a	6						7a	6						7a	6	
7b	4						7b	4						7b	4	
	totals							totals								

the end