(*a*) Show that $x = 2$ is a root of the equation $2x^3 + x^2 - 13x + 6 = 0$. 1

(*b*) Hence find the other roots. 3

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Content Reference: Additional	2.1
(a)	1	2.1	1						2.1.1		Source
(b)	3	2.1	3						2.1.2		**1999 P1 qu.1**

•1 $f(2) = 16 + 4 - 26 + 6 = 0$

or

the appearance of a '0' at the end of the 3rd line in the table below

•2

2	2	1	–13	6
		4	10	–6
	2	5	–3	0

•3 $2x^2 + 5x - 3$

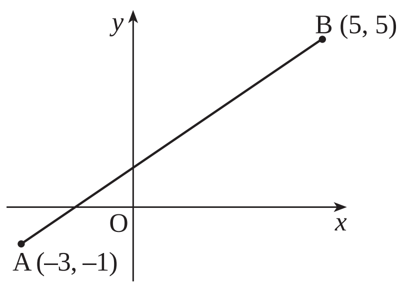
•4 $-3, \frac{1}{2}$

A and B are the points (–3, –1) and (5, 5).

Find the equation of

(*a*) the line AB 2

(*b*) the perpendicular bisector of AB. 3



part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Content Reference: Additional	1.1
(a)	2	1.1					2		1.1.7		Source
(b)	3	1.1					3		1.1.10		**1999 P1 qu.2**

•1 $m_{AB} = \frac{3}{4}$

•2 $y - 5 = \frac{3}{4}(x - 5)$ *or* $y - (-1) = \frac{3}{4}(x - (-3))$

•3 $m_{\perp} = -\frac{4}{3}$

•4 midpoint $= (1, 2)$

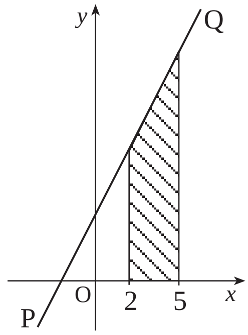
•5 $y - 2 = -\frac{4}{3}(x - 1)$

The line PQ has equation $y = 2x + 4$.

(*a*) Find, without using calculus, the area of the shaded trapezium shown in the diagram. 2

(*b*) Express the area of this trapezium as a definite integral. 1

(*c*) Evaluate this integral. 2



part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	2.5
(a)	2	0.1	2						0.1		Source
(b)	1	2.2	1						2.2.6		1999 P1 qu.3
(c)	2	2.2	2						2.2.5		

•[1] evidence of e.g. triangle + rectangle

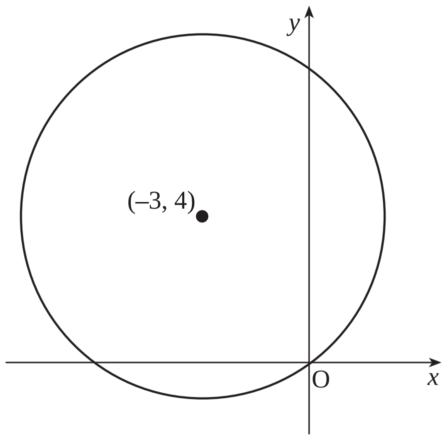
•[2] area = 33

•[3] $\int_2^5 (2x+4)\ dx$

•[4] $x^2 + 4x$

•[5] $45 - 12 = 33$

Find the equation of the circle with centre (–3, 4) and passing through the origin. 2



part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	2.4
.	2	2.4					2		2.4.3		Source 1999 P1 qu.4

•[1] $r^2 = 25$ stated or implied by •[2].

•[2] $(x+3)^2 + (y-4)^2 = 25$

Given $f(x) = 3x^2(2x - 1)$ find $f'(-1)$. 3

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.3
			C	A / B	C	A / B	C	A / B	Main	Additional	Source
.	3	1.3	3						1.3.4		**1999 P1 qu.5**

$\bullet^1$ $6x^3 - 3x^2$

$\bullet^2$ $18x^2 - 6x$

$\bullet^3$ 24

VABCD is a pyramid with rectangular base ABCD.

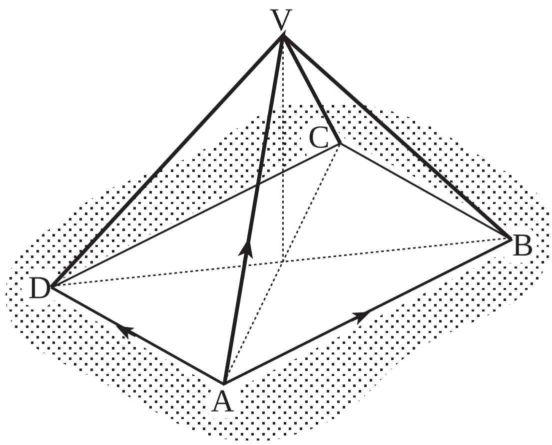
The vectors $\vec{AB}$, $\vec{AD}$ and $\vec{AV}$ are given by

$\vec{AB} = 8\boldsymbol{i} + 2\boldsymbol{j} + 2\boldsymbol{k}$

$\vec{AD} = -2\boldsymbol{i} + 10\boldsymbol{j} - 2\boldsymbol{k}$ and

$\vec{AV} = \boldsymbol{i} + 7\boldsymbol{j} + 7\boldsymbol{k}$.

Express $\vec{CV}$ in component form. 3



part	marks	Unit	non-calc		calc		calc neut		Content Reference :		3.1
			C	A / B	C	A / B	C	A / B	Main	Additional	Source
.	3	3.1					3		3.1.8		**1999 P1 qu.6**

$\bullet^1$ pathway for $\vec{CV}$: $\vec{CV} = \vec{CA} + \vec{AV}$

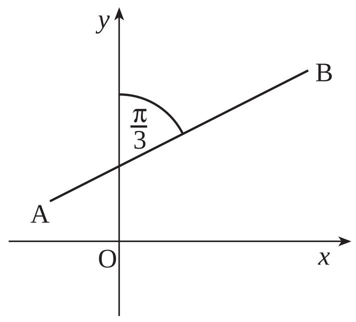
$\bullet^2$ *e.g.* $\vec{CB} = 2i - 10j + 2k$

or $\vec{BA} = -8i - 2j - 2k$

or $\vec{AC} = 6i + 12j$

$\bullet^3$ $\begin{pmatrix} -5 \\ -5 \\ 7 \end{pmatrix}$

The line AB makes an angle of $\frac{\pi}{3}$ radians with the y-axis, as shown in the diagram. Find the exact value of the gradient of AB. 2



part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	1.1
.	2	1.1						2	1.1.7		Source 1999 P1 qu.7

•[1] "correct angle" $= \frac{\pi}{2} - \frac{\pi}{3}$

•[2] $\frac{1}{\sqrt{3}}$

(i) Write down the condition for the equation $ax^2 + bx + c = 0$ to have no real roots. 1

(ii) Hence or otherwise show that the equation $x(x+1) = 3x - 2$ has no real roots. 2

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference : Main	Additional	2.1
(i)	1	2.1					1		2.1.6		Source
(ii)	2	2.1					2		2.1.6		1999 P1 qu.8

•[1] $b^2 - 4ac = 0$

•[2] $x^2 + 6x + 9 = 0$

•[3] $b^2 - 4ac = 36 - 36 = 0$ ***OR*** •[3] $(x+3)(x+3) = 0$ so roots are $-3, -3$

The point P(–1, 7) lies on the curve with equation $y = 5x^2 + 2$. Find the equation of the tangent to the curve at P. 4

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Content Reference: Additional	1.3
.	4	1.3	4						1.3.9	1.1.7	Source **1999 P1 qu.9**

•1 $\frac{dy}{dx} = \ldots\ldots$

•2 $10x$

•3 -10

•4 $y - 7 = -10(x - (-1))$

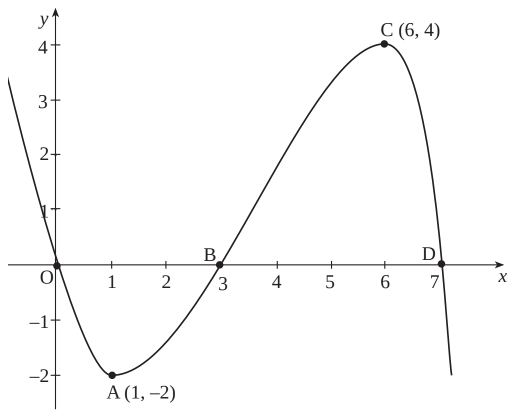
Part of the graph of $y = f(x)$ is shown in the diagram. 1

On separate diagrams sketch the graphs of

(*a*) $y = f(x+1)$

(*b*) $y = -2f(x)$.

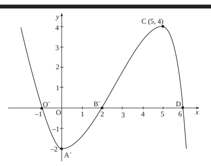
Indicate on each graph the images of O, A, B, C and D.



part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Content Reference: Additional	1.2
(a)	2	1.2	2						1.2.4		Source
(b)	3	1.2	1	2					1.2.4		**1999 P1 qu.10**

•1 translation of $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$

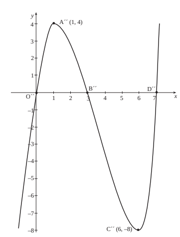
•2 positions of images of A, B, C, D, O clear from the sketch



•3 reflect in x - axis

•4 double y - coordinates

•5 positions of images of A, B, C, D, O clear from the sketch



The graph of $y = g(x)$ passes through the point (1,2).

If $\frac{dy}{dx} = x^3 + \frac{1}{x^2} - \frac{1}{4}$, express y in terms of x. 4

part	marks	Unit	non-calc		calc		calc neut		Content Reference :	2.2
			C	A/B	C	A/B	C	A/B	Main Additional	Source
.	4	2.2	4						2.2.8	**1999 P1 qu.11**

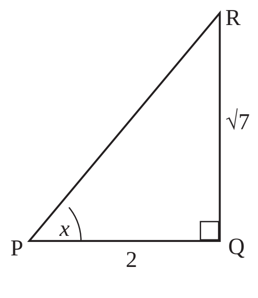
•1 x^{-2} *stated or implied by* •2 *or* •3

•2 $y = \int (x^3 + x^{-2} - \tfrac{1}{4})dx$ ***or*** the appearance of any term of $\tfrac{1}{4}x^4 - \tfrac{1}{4}x - x^{-1}$

•3 the remaining two terms

•4 $c = 3$

Using triangle PQR, as shown, find the exact value of cos $2x$. 3



part	marks	Unit	non-calc		calc		calc neut		Content Reference :	2.3
			C	A/B	C	A/B	C	A/B	Main Additional	Source
.	3	2.3	3						2.3.3	**1999 P1 qu.12**

•1 $\cos x = \frac{2}{\sqrt{11}}$ *or* $\sin x = \frac{\sqrt{7}}{\sqrt{11}}$

•2 $\cos 2x = 2 \times \left(\frac{2}{\sqrt{11}}\right)^2 - 1$

•3 $-\frac{3}{11}$

(*a*) Show that $f(x) = 2x^2 - 4x + 5$ can be written in the form $f(x) = a(x+b)^2 + c$. 3

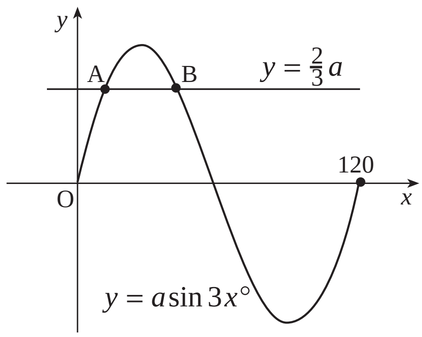
(*b*) Hence write down the coordinates of the stationary point of $y = f(x)$ and state its nature. 2

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.2
			C	A / B	C	A / B	C	A / B	Main	Additional	Source
(a)	3	1.2	3						1.2.8		**1999 P1 qu.13**
(b)	2	1.2	2						1.2.9		

- •[1] $2(x^2 - 2x) + 5$ *stated or implied by* •[3]
- •[2] $2(x-1)^2 + \ldots\ldots$ *stated or implied by* •[3]
- •[3] $2(x-1)^2 + 3$
- •[4] stationary pt at $(1, 3)$
- •[5] stationary pt is minimum

The diagram shows part of the graph of $y = a\sin 3x°$ and the line with equation $y = \frac{2}{3}a$.

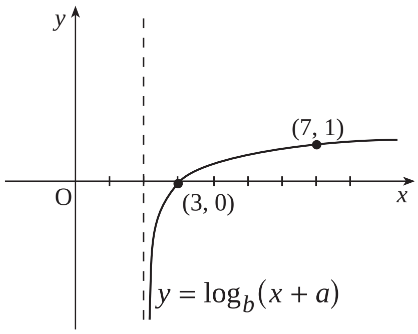
Find the x-coordinates of A and B. 4



part	marks	Unit	non-calc		calc		calc neut		Content Reference :		2.3
			C	A / B	C	A / B	C	A / B	Main	Additional	Source
.	4	2.3	4						2.3.1		**1999 P1 qu.14**

- •[1] $a\sin 3x = \frac{2}{3}a$ *stated or implied by* •[2]
- •[2] $\sin 3x = \frac{2}{3}$
- •[3] $3x = 41.8,\ 138.2$ (138.2 *stated or implied by* 46.1 in •[4])
- •[4] 13.9, 46.1

The diagram shows part of the graph of $y = \log_b(x+a)$.
Determine the values of a and b. 3



part	marks	Unit	non-calc		calc		calc neut		Content Reference :		3.3
			C	A / B	C	A / B	C	A / B	Main	Additional	Source
.	3	3.3						3	3.3.1	1.2.5	**1999 P1 qu.15**

•[1] $a = -2$
•[2] $1 = \log_b(7-2)$
•[3] $b = 5$

OR

•[1] $1 = \log_b(7+a)$ **and** $0 = \log_b(a+3)$
•[2] $7 + a = b$ **and** $a + 3 = b^0$
•[3] $a = -2,\ b = 5$

A curve has equation $y = 2x^3 + 3x^2 + 4x - 5$.
Prove that this curve has no stationary points. 5

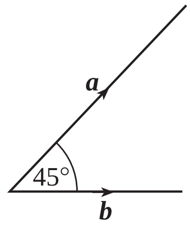
part	marks	Unit	non-calc		calc		calc neut		Content Reference :		1.3
			C	A / B	C	A / B	C	A / B	Main	Additional	Source
.	5	1.3	2	3					1.3.12	1.3.11	**1999 P1 qu.16**

•[1] $\frac{dy}{dx} = \ldots\ldots$
•[2] $6x^2 + 6x + 4$
•[3] *e.g.* "$b^2 - 4ac$" $= \ldots\ldots$
•[4] -60 *or* -15 (from $3x^2 + 3x + 2$)
•[5] Δ negative so no st. points

OR

•[1] $\frac{dy}{dx} = \ldots\ldots$
•[2] $6x^2 + 6x + 4$
•[3] *e.g.* complete square……
•[4] $S = 6\left(x + \frac{1}{2}\right)^2 + 2\frac{1}{2}$
•[5] $S \geq 2\frac{1}{2}$ so no st. points

The diagram shows two vectors **a** and **b**, with $|\mathbf{a}| = 3$ and $|\mathbf{b}| = 2\sqrt{2}$.
These vectors are inclined at an angle of 45° to each other.



(*a*) Evaluate (i) $\mathbf{a.a}$
(ii) $\mathbf{b.b}$
(iii) $\mathbf{a.b}$ 2

(*b*) Another vector **p** is defined by $\mathbf{p} = 2\mathbf{a} + 3\mathbf{b}$.
Evaluate $\mathbf{p.p}$ and hence write down $|\mathbf{p}|$. 4

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Additional	3.1
(a)	2	3.1					2		3.1.9		Source
(b)	4	3.1						4	3.1.9		1999 P1 qu.17

•1 $a.a = 9$ **and** $b.b = 8$

•2 $a.b = 6$

•3 $(2a+3b).(2a+3b)$

•4 $4a.a + 9b.b + 12a.b$

•5 180

•6 $\sqrt{180}$

Two sequences are defined by the recurrence relations

$u_{n+1} = 0 \cdot 2u_n + p, \quad u_0 = 1$ and

$v_{n+1} = 0 \cdot 6v_n + q, \quad v_0 = 1.$

If both sequences have the same limit, express p in terms of q. 3

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Additional	1.4
.	3	1.4						3	1.4.5		Source
											1999 P1 qu.18

•1 "$L = 0.2L + p, \quad L = 0.6L + q$" *or use* "$l = \frac{b}{1-a}$"

•2 $\frac{p}{0.8}$ *and* $\frac{q}{0.4}$

•3 $p = \frac{0.8q}{0.4}$ or equivalent expression for p

Given $f(x) = \cos^2 x - \sin^2 x$, find $f'(x)$. 3

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		3.2
			C	A/B	C	A/B	C	A/B	Main	Additional	Source
.	3	3.2	1	2					3.2.2	3.2.1	1999 P1 qu.19

•1 $f(x) = \cos 2x$

•2 $-\sin 2x$

•3 $\times\ 2$

For $\frac{d}{dx}(\cos^2 x)$

•1 $2\cos x$

•2 $\times -\sin x$

For $\frac{d}{dx}(-\sin^2 x)$

•3 $-2\sin x \times \cos x$

OR

For $\frac{d}{dx}(-\sin^2 x)$

•1 $-2\sin x$

•2 $\times \cos x$

For $\frac{d}{dx}(\cos^2 x)$

•3 $2\cos x \times -\sin x$

Find $\int \frac{x^2 - 5}{x\sqrt{x}}\, dx$. 4

part	marks	Unit	non-calc		calc		calc neut		Content Reference :		2.2
			C	A/B	C	A/B	C	A/B	Main	Additional	Source
.	4	2.2	2	2					2.2.4		1999 P1 qu.20

•1 $\left(\frac{x^2}{x\sqrt{x}} = \right)\ x^{\frac{1}{2}}$

•2 $\left(\frac{-5}{x\sqrt{x}} = \right)\ -5x^{-\frac{3}{2}}$

•3 $\frac{x^{\frac{3}{2}}}{\frac{3}{2}}$

•4 $\frac{-5}{-\frac{1}{2}}x^{-\frac{1}{2}}$

A function f can be expressed as an infinite series by $f(x) = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \frac{x^5}{120} + \ldots\ldots\ldots$

(*a*) Write down the series for $f(2x)$ as far as the term in x^5. 1

The derivative of $f(x)$ can be calculated as follows:

$$f(x) = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \frac{x^5}{120} + \ldots\ldots\ldots$$

$$\text{so} \quad f'(x) = 0 + 1 + \frac{2x}{2} + \frac{3x^2}{6} + \frac{4x^3}{24} + \frac{5x^4}{120} + \ldots\ldots\ldots$$

$$= 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \ldots\ldots\ldots$$

$$\text{i.e.} \quad f'(x) = f(x)$$

(*b*) If $g(x) = f(2x)$ find $g'(x)$ and express it in terms of $f(2x)$. 3

part	marks	Unit	non-calc C	non-calc A/B	calc C	calc A/B	calc neut C	calc neut A/B	Content Reference: Main	Additional	0.1
(a)	1	0.1						1	0.1		Source
(b)	3	0.1						3	0.1	1.3.4	**1999 P1 qu.21**

•1 $1 + 2x + \frac{(2x)^2}{2} + \frac{(2x)^3}{6} + \frac{(2x)^4}{24} + \frac{(2x)^5}{120}$

•2 $1 + 2x + 2x^2 + \frac{4}{3}x^3 + \frac{2}{3}x^4 + \frac{4}{15}x^5$

•3 $2 + 4x + 4x^2 + \frac{8}{3}x^3 + \frac{4}{3}x^4$

•4 $2\left(1 + 2x + 2x^2 + \frac{4}{3}x^3 + \frac{2}{3}x^4\right)$ ***and*** $2f(2x)$