1. (a) Using the fact that $\frac{7\pi}{12} = \frac{\pi}{3} + \frac{\pi}{4}$, find the exact value of $\sin\left(\frac{7\pi}{12}\right)$. 3

(b) Show that $\sin(A+B) + \sin(A-B) = 2\sin A\cos B$. 2

(c) (i) Express $\frac{\pi}{12}$ in terms of $\frac{\pi}{3}$ and $\frac{\pi}{4}$.

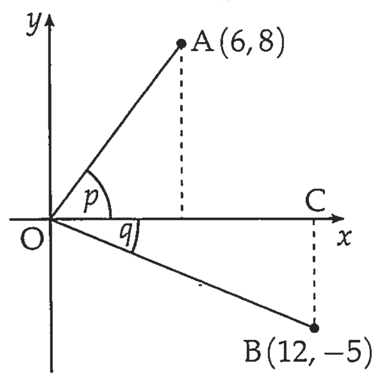
(ii) Hence or otherwise find the exact value of $\sin\left(\frac{7\pi}{12}\right) + \sin\left(\frac{\pi}{12}\right)$. 4

Part	Marks	Level	Calc.	Content	Answer	U2 OC3
(a)	3	C	NC	T8, T3	$\frac{\sqrt{3}+1}{2\sqrt{2}}$	2009 P1 Q24
(b)	2	C	CN	T8	proof	
(c)	3	B	NC	T11	$\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$	
(c)	1	C	NC	T11	$\frac{\sqrt{6}}{2}$ or $\sqrt{\frac{3}{2}}$	

•1 ss: - expand compound angle	•1 $\sin\frac{\pi}{3}\cos\frac{\pi}{4} + \cos\frac{\pi}{3}\sin\frac{\pi}{4}$
•2 ic: substitute exact values	•2 $\frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}} + \frac{1}{2} \times \frac{1}{\sqrt{2}}$
•3 pd: process to a single fraction	•3 $\frac{\sqrt{3}+1}{2\sqrt{2}}$ or equivalent
•4 ic: start proof	•4 $\sin A\cos B + \cos A\sin B + \cdots$
•5 ic: complete proof	•5 $\cdots + \sin A\cos B - \cos A\sin B$ and complete
•6 ss: identify steps	•6 $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$
•7 ic: start process (identify 'A' & 'B')	•7 $2 \times \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{2}}$
•8 ic: substitute	•8 $\frac{\sqrt{6}}{2}$ or $\sqrt{\frac{3}{2}}$
•9 pd: process	

2. [SQA] On the coordinate diagram shown, A is the point (6, 8) and B is the point (12, −5). Angle AOC = p and angle COB = q.

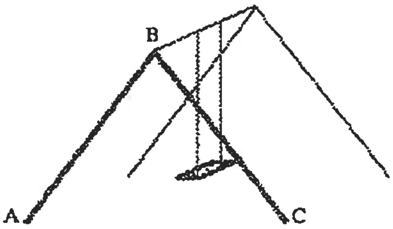
Find the exact value of $\sin(p+q)$. 4

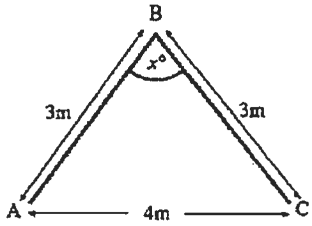


Part	Marks	Level	Calc.	Content	Answer	U2 OC3
	4	C	NC	T9	$\frac{63}{65}$	2000 P1 Q1

•1 ss: know to use trig expansion	•1 $\sin p\cos q + \cos p\sin q$
•2 pd: process missing sides	•2 10 and 13
•3 ic: interpret data	•3 $\frac{8}{10}\cdot\frac{12}{13} + \frac{6}{10}\cdot\frac{5}{13}$
•4 pd: process	•4 $\frac{126}{130}$

3. [SQA] The framework of a child's swing has dimensions as shown in the diagram on the right. Find the exact value of $\sin x°$. 5





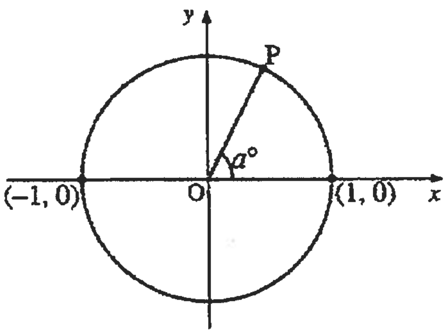
Part	Marks	Level	Calc.	Content	Answer	U2 OC3
	1	C	NC	T9		1996 P1 Q18
	4	A/B	NC	T9		

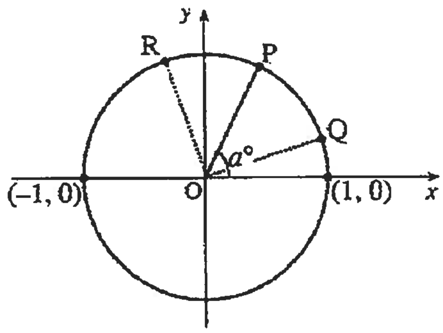
- •1 sketch with $\frac{x}{2}$ marked in r/a Δ
- •2 height of triangle $= \sqrt{5}$
- •3 $\sin x = 2\sin\frac{1}{2}x\cos\frac{1}{2}x$
- •4 $\sin\frac{x}{2} = \frac{2}{3}$ *and* $\cos\frac{1}{2}x = \frac{\sqrt{5}}{3}$
- •5 $\sin x = \frac{4\sqrt{5}}{9}$

OR

- •1 know to use cosine rule
- •2 $\cos x = \frac{3^2+3^2-4^2}{2.3.3}$
- •3 $\frac{1}{9}$
- •4 draw r/a Δ *or* use $\cos^2 x + \sin^2 x = 1$
- •5 $\sin x = \frac{\sqrt{80}}{9}$

4. [SQA] The diagram shows a circle of radius 1 unit and centre the origin. The radius OP makes an angle $a°$ with the positive direction of the x-axis.





(*a*) Show that P is the point $(\cos a°, \sin a°)$. 1

(*b*) If $\hat{POQ} = 45°$, deduce the coordinates of Q in terms of a. 1

(*c*) If $\hat{POR} = 45°$, deduce the coordinates of R in terms of a. 1

(*d*) Hence find an expression for the gradient of QR in its simplest form. 4

(*e*) Show that the tangent to the circle at P is parallel to QR. 2

(*a*) •1 proof e.g. showing rt-angled triangle with "1" and a°

(*b*) •2 Q is $(\cos(a-45)°, \sin(a-45)°)$

(*c*) •3 R is $(\cos(a+45)°, \sin(a+45)°)$

(*d*) •4 $\frac{\sin(a+45)-\sin(a-45)}{\cos(a+45)-\cos(a-45)}$

•5 $\frac{\sin a\cos 45+\cos a\sin 45-\sin a\cos 45+\cos a\sin 45}{\cos a\cos 45-\sin a\sin 45-\cos a\cos 45-\sin a\sin 45}$

•6 $\frac{2\cos a\sin 45}{-2\sin a\sin 45}$

•7 $-\frac{1}{\tan a}$

(*e*) •8 $m_{OP} = \frac{\sin a}{\cos a} = \tan a$

•9 $m_{tgt\ at\ P} = -\frac{1}{\tan a}$