1a) $f(x) = 3\cos x - 4\sin x$

$\cos(A+B) = \cos A \cos B - \sin A \sin B$

$R\cos(x+\alpha) = R\cos x \cos\alpha - R\sin x \sin\alpha$

$3 = R\cos\alpha \qquad 4 = R\sin\alpha$

$R = \sqrt{3^2+4^2}$ $\qquad \tan\alpha = \frac{4}{3}$

$= 5$ $\qquad \alpha = 53.1 \quad (1\,dp)$

b) $5\cos(x+53.1) = 1$

$\cos(x+53.1) = 1/5$

$x + 53.1 = 78.5, 281.5$

$x = 25.3, 228.4$

[answers from using all digits on calculator]

c) -5

d) $5\cos(x+53.1) = -5$

$\cos(x+53.1) = -1$

$x + 53.1 = 180$

$x = 126.9^\circ \quad (1\,dp)$

2a) $5 \sin x + 12 \cos x$

$R \sin(x + \alpha) = R \sin x \cos \alpha + R \cos x \sin \alpha$

$5 = R \cos \alpha \qquad 12 = R \sin \alpha$

$R = \sqrt{5^2 + 12^2}$ $\qquad \tan \alpha = 12/5$

$= 13$ $\qquad \alpha = 67.4 \quad (1dp)$

$$13 \sin(x + 67.4)$$

b) Maximum value : 13

$13 \sin(x + 67.4) = 13$

$\sin(x + 67.4) = 1$

$x + 67.4 = 90$

$x = 22.6$

3/ $f(x) = 5\cos\theta + \sin\theta$

$R\cos(\theta - \alpha) = R\cos\theta\cos\alpha + R\sin\theta\sin\alpha$

$5 = R\cos\alpha \qquad 1 = R\sin\alpha$

$R = \sqrt{5^2 + 1^2}$ $\qquad \tan\alpha = \frac{1}{5}$

$= \sqrt{26}$ $\qquad \alpha = 0.197$

b/ $\sqrt{26}\cos(\theta - 0.197) = 2$

$\cos(\theta - 0.197) = \frac{2}{\sqrt{26}}$

$\theta - 0.197 = 1.17, 5.12$

$\theta = \underline{1.37}, \underline{5.31}$

c/ $\sqrt{26}\cos(4x - 0.197) + 15$

Min ~~point at~~ value: $\underline{15 - \sqrt{26}}$

d/ $\sqrt{26}\cos(4x - 0.197) + 15 = 15 - \sqrt{26}$

$\cos(4x - 0.197) = -1$

$4x - 0.197 = \pi$

$x = \underline{0.83}$

4a) $2 \sin x - 3 \cos x$

$R \sin(x - \alpha) = R \sin x \cos \alpha - R \cos x \sin \alpha$

$2 = R \cos \alpha \qquad 3 = R \sin \alpha$

$R = \sqrt{2^2 + 3^2}$ $\qquad \tan \alpha = 3/2$

$= \sqrt{13}$ $\qquad \alpha = 0.983 \quad (3dp)$

$\sqrt{13} \sin(x - 0.983)$

b) $\left(\sqrt{13} \sin(x - 0.983)\right)^2$

Max value : 13

$\left(\sqrt{13} \sin(x - 0.983)\right)^2 = 13$

$\sqrt{13} \sin(x - 0.983) = \pm\sqrt{13}$

$\sin(x - 0.983) = \pm 1$

$(x - 0.983) = \frac{\pi}{2}$ (smallest +ve ans)

$x = \underline{2.55}$

c) $\sqrt{13} \sin(x - 0.983) = 1$

$\sin(x - 0.983) = \frac{1}{\sqrt{13}}$

$x - 0.983 = 0.281, \ 2.861$

$x = \underline{1.264}, \ \underline{3.843}$