Homework 04-12
Trigonometric Graphs
Complete the booklet of questions.

Trigonometry

1. Trigonometry, EXT1 T3 2014 HSC 2 MC

   Which expression is equal to $\cos x - \sin x$?

   A. $\sqrt{2}\cos\left(x + \dfrac{\pi}{4}\right)$

   B. $\sqrt{2}\cos\left(x - \dfrac{\pi}{4}\right)$

   C. $2\cos\left(x + \dfrac{\pi}{4}\right)$

   D. $2\cos\left(x - \dfrac{\pi}{4}\right)$

2. Trigonometry, EXT1 T3 2017 HSC 4 MC

   What is the value of $\tan\alpha$ when the expression $2\sin x - \cos x$ is written in the form $\sqrt{5}\sin(x - \alpha)$?

   A. -2

   B. $-\dfrac{1}{2}$

   C. $\dfrac{1}{2}$

   D. 2

3. Trigonometry, EXT1 T3 2015 HSC 11d

   Express $5\cos x - 12\sin x$ in the form $A\cos(x + \alpha)$, where $0 \le \alpha \le \dfrac{\pi}{2}$. *(2 marks)*

4. Trigonometry, EXT1 T3 2018 HSC 11c

   Write $\sqrt{3}\sin x + \cos x$ in the form $R\sin(x + \alpha)$ where $R > 0$ and $0 \le \alpha \le \dfrac{\pi}{2}$. *(2 marks)*

5. Trigonometry, EXT1 T3 2013 HSC 12a

   i. Write $\sqrt{3}\cos x - \sin x$ in the form $2\cos(x + \alpha)$, where $0 < \alpha < \dfrac{\pi}{2}$. *(1 mark)*

   ii. Hence, or otherwise, solve $\sqrt{3}\cos x = 1 + \sin x$, where $0 < x < 2\pi$. *(2 marks)*

6. Trigonometry, EXT1 T3 2004 HSC 2d

   i. Write $8\cos x + 6\sin x$ in the form $A\cos(x - \alpha)$, where $A > 0$ and $0 \le \alpha \le \dfrac{\pi}{2}$. *(2 marks)*

   ii. Hence, or otherwise, solve the equation $8\cos x + 6\sin x = 5$ for $0 \le x \le 2\pi$.
   Give your answers correct to three decimal places. *(2 marks)*

7. Trigonometry, EXT1 T3 2009 HSC 2b

i. Express $3\sin x + 4\cos x$ in the form $A\sin(x + \alpha)$ where $0 \le \alpha \le \dfrac{\pi}{2}$. *(2 marks)*

ii. Hence, or otherwise, solve $3\sin x + 4\cos x = 5$ for $0 \le x \le 2\pi$.
Give your answer, or answers, correct to two decimal places. *(2 marks)*

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8. Trigonometry, EXT1 T3 2020 HSC 11d

By expressing $\sqrt{3}\sin x + 3\cos x$ in the form $A\sin(x + a)$, solve $\sqrt{3}\sin x + 3\cos x = \sqrt{3}$, for $0 \le x \le 2\pi$. *(4 marks)*

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9. Trigonometry, EXT1 T3 2022 HSC 11e

Express $\sqrt{3}\sin(x) - 3\cos(x)$ in the form $R\sin(x + \alpha)$. *(3 marks)*

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10. Trigonometry, EXT1 T3 EQ-Bank 4

The current flowing through an electrical circuit can be modelled by the function

$$f(t) = 6\sin 0.05t + 8\cos 0.05t, \quad t \ge 0$$

i. Express the function in the form $f(t) = A\sin(at + b)$, for $0 \le b \le \dfrac{\pi}{2}$. *(2 marks)*

ii. Find the time at which the current first obtains it maximum value. *(1 mark)*

iii. Sketch the graph of $f(t)$. Clearly show its range and label the coordinates of its first maximum value. Do not label x-intercepts. *(1 mark)*

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11. Trigonometry, EXT1 T3 2010 HSC 4b

i. Express $2\cos\theta + 2\cos\left(\theta + \dfrac{\pi}{3}\right)$ in the form $R\cos(\theta + \alpha)$,

where $R > 0$ and $0 < \alpha < \dfrac{\pi}{2}$. *(3 marks)*

ii. Hence, or otherwise, solve $2\cos\theta + 2\cos\left(\theta + \dfrac{\pi}{3}\right) = 3$,

for $0 < \theta < 2\pi$. *(2 marks)*

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12. Trigonometry, EXT1 T3 EQ-Bank 2

A particular energy wave can be modelled by the function

$$f(t) = \sqrt{5}\sin 0.2t + 2\cos 0.2t, \quad t \in [0, 50]$$

i. Express this function in the form $f(t) = R\sin(nt - \alpha)$, $\alpha \in [0, 2\pi]$. *(2 marks)*

ii. Find the time the wave first attains its maximum value. Give your answer to one decimal place. *(2 marks)*