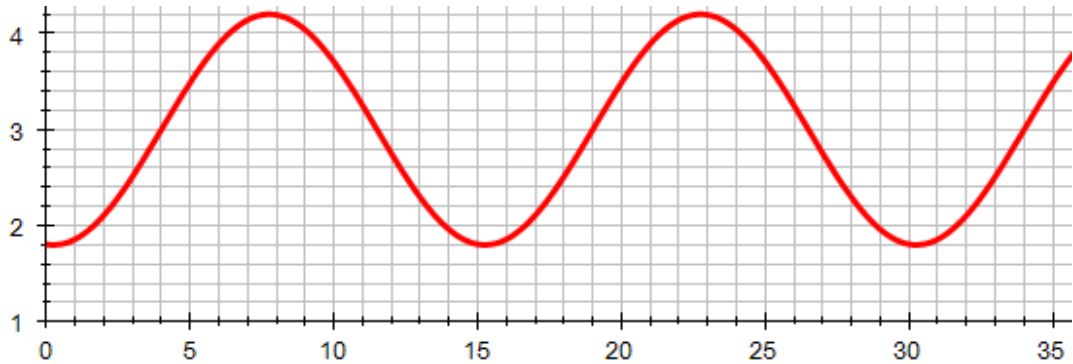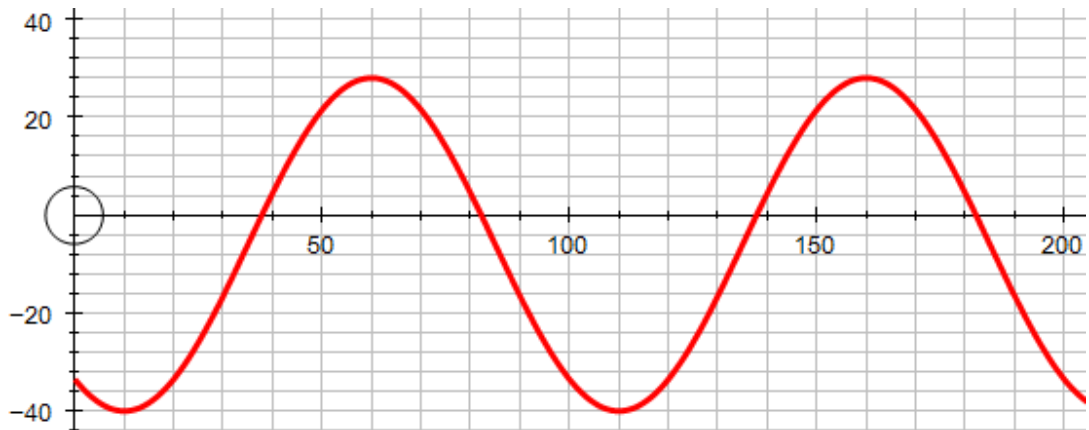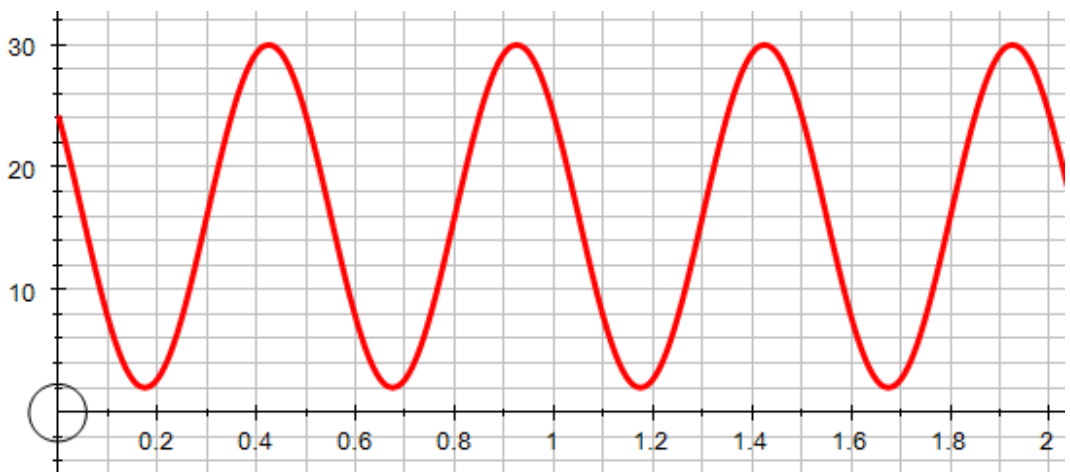# Calculus Trigonometry Practice #3

1.

Write equations for the graph above, and then a general solution for when it is more than 3.8.

2.

Write equations for the graph above, and then a general solution for when it is less than ⁻20.

3.

Write equations for the graph above, and then a general solution for when it is more than 17.

Answers: Calculus Trigonometry Practice #3

Solutions may be done with different trig equations from those shown.

1. y from 1.8 to 4.2, so centred on 3, with an amplitude of 1.2

    Sine starts at $x = 4$, as $y = 3$ there, with a next repeat at 19, so it has a period of 15

    $y = 1.2 \sin \left(\frac{2\pi}{15} (x - 4) \right) + 3$

    Cos starts a quarter period later, so **$y = 1.2 \cos \left(\frac{2\pi}{15} (x - 7.75) \right) + 3$**

    Solving $3.8 = 1.2 \sin \left(\frac{2\pi}{15} (x - 4) \right) + 3$ $\qquad$ $x = \sin^{-1}\left(\frac{0.8}{1.2} \right) \times \frac{15}{2\pi} + 4 = 5.742$ on up-slope

    Need down-slope, other side of peak at $x = 7.75 = 9.758$ is down solution

    Using standard forms: $x = 4 + 7.5n + (^-1)^n \times 1.742$ $\qquad$ or $\qquad$ $x = 7.75 + 15n \pm 2.008$

    $15n - 9.258 < x < 15n - 4.016$ where $n \in \mathbb{Z}$ and $n = 1$ is first positive solution

2. y from $^-40$ to 28, so centred on $^-6$, with an amplitude of 34.

    Peak at $x = 60$, repeating every 100, so $\qquad$ **$y = 34 \cos \left(\frac{2\pi}{100} (x - 60) \right) - 6$**

    Sin starts a quarter period before, so $\qquad$ **$y = 34 \sin \left(\frac{2\pi}{100} (x - 35) \right) - 6$**

    Solving $^-20 = 34 \cos \left(\frac{2\pi}{100} (x - 60) \right) - 6$ $\qquad$ $x = \cos^{-1}\left(\frac{-14}{34} \right) \times \frac{100}{2\pi} + 60 = 91.75$ (down)

    Need up-slope, other side of peak at $x = 60$ gives 28.25 is up solution

    Using standard forms: $x = 35 + 50n + (^-1)^n \times {}^-6.75$ $\qquad$ or $\qquad$ $x = 60 + 100n \pm 31.75$

    Note we need troughs here though, so $x = 10 + 100n \pm 18.25$ is better

    $100n - 108.25 < x < 100n - 71.75$ where $n \in \mathbb{Z}$ and $n = 1$ is first trough after 0

3. y from 2 to 30, so centred on 16, with an amplitude of 14

    Sine starts at $x = 0.3$, as $y = 16$ there, with a next repeat at 0.8, so it has a period of 0.5

    $y = 14 \sin \left(\frac{2\pi}{0.5} (x - 0.3) \right) + 16$

    Cos starts a quarter period later, so **$y = 14 \cos \left(\frac{2\pi}{0.5} (x - 0.425) \right) + 16$**

    Solving $17 = 14 \sin \left(\frac{2\pi}{0.5} (x - 0.3) \right) + 16$ $\qquad$ $x = \sin^{-1}\left(\frac{1}{14} \right) \times \frac{0.5}{2\pi} + 0.3 = 0.306$ on up-slope

    Need down-slope, other side of peak at $x = 0.425 = 0.544$ is down solution

    Using standard forms: $x = 0.3 + 0.25n + (^-1)^n \times 0.006$ $\qquad$ or $\qquad$ $x = 0.425 + 0.5n \pm 0.119$

    $0.5n - 0.194 < x < 0.5n + 0.044$ where $n \in \mathbb{Z}$ and $n = 1$ is first positive solution