Question 1:

(a)[2 points] Convert $-405°$ to radians.

(b)[4 points] Find the exact value of $\sec\left(10\pi/3\right)\sin\left(-3\pi/4\right)$.

(c)[4 points] If $\cos\left(t\right) = -1/5$, find all possible values of $\sin(t)$.

Question 2:

(a)[3 points] Find all angles $0 \leq \theta < 2\pi$ such that $\sin \theta = \sqrt{3}/2$.
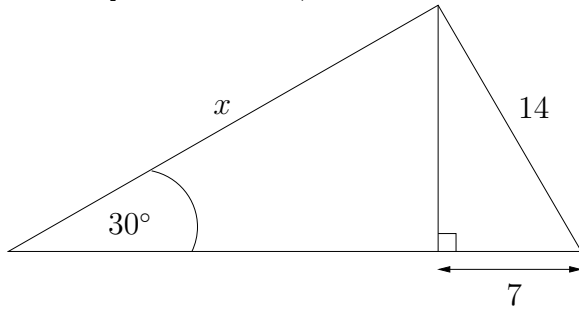
(b)[3 points] Find the exact value of $\sin(11\pi/12)$ (note: $2/3+1/4=11/12$).

(c)[4 points] Simplify to an expression which does not contain trigonometric functions:
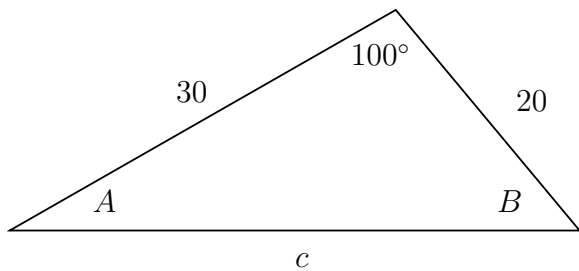
$$\sin(\arccos(x/2))$$

Question 3:

(a)[4 points] Solve for x (round final answer to one decimal):

(b)[4 points] Find all remaining sides and angles in the following figure (round final answers to one decimal):

(c)[2 points] Find the exact value of $\log_{\frac{1}{2}} 16$

Question 4:

(a)[2 points] Find the x intercept of the graph of $y = \log_7 (2x - 3) - 2$.

(b)[2 points] Simplify:

$$\ln \left(\frac{1}{4} e^{3x} \right) - \ln \left(e^{2x} \right) + \ln 4$$

(c)[3 points] Let $\mathbf{A} = \begin{bmatrix} 2 & -1 \\ 0 & 2 \end{bmatrix}$, $\mathbf{B} = \begin{bmatrix} 3 & -5 \\ -9 & 2 \end{bmatrix}$, and $\mathbf{C} = \begin{bmatrix} -2 & 2 \\ 4 & -1 \end{bmatrix}$. Compute $(\mathbf{B} - 2\mathbf{C}) \, \mathbf{A}^{\mathrm{T}}$.

(d)[3 points] Let $\mathbf{A} = \begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix}$. Find $\mathbf{A}^{-1}$.

Question 5:

(a)[3 points] Find the 11th term of the arithmetic sequence $\dfrac{7}{6}, \dfrac{5}{6}, \ldots$

**(b)[3 points]** A geometric sequence has $a_3 = 1/2$ and $a_8 = -512$. What is a_6?

(c)[4 points] An arithmetic series has first term 7, last term -47 and common difference between terms of $d = -3$. Find the sum of the series.

Question 6:

(a)[7 points] Carefully sketch the graph of $f(x) = \dfrac{1}{2} \sin\left(2x - \dfrac{\pi}{2}\right) - \dfrac{1}{2}$ showing at least one complete cycle of the function. Label and indicate the scale on your axes.

(b)[3 points] State the amplitude, period and phase-shift of the function graphed in (a).

Question 7: A rocket traveling at 250 metres per second is climbing at an angle of 20° as shown in the figure below. A radar station at point C located 2000 metres from the launch point A is tracking the rocket.
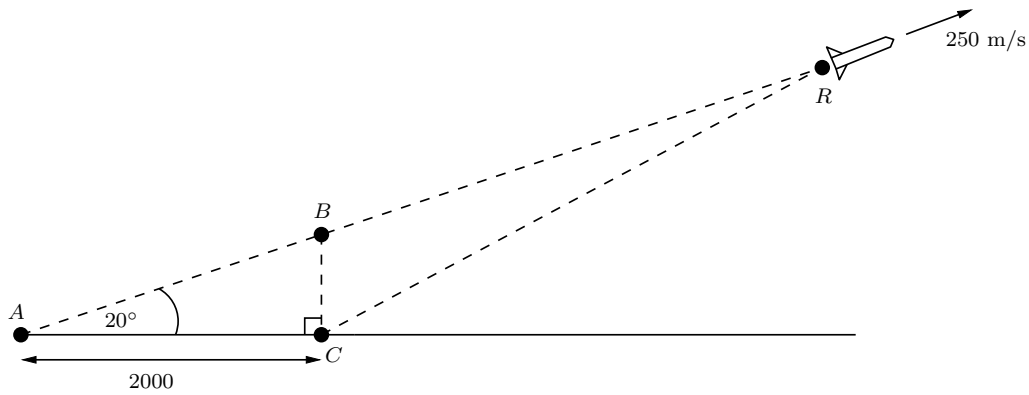
(a)[3 points] What is the distance from the launch point A to the rocket at R three seconds after the rocket passes through point B? (round your answer to the nearest metre.)

(b)[4 points] How far is the rocket at R from the radar station C at this same instant? (round your answer to the nearest metre.)

(c)[3 points] How high above the ground is the rocket at this same instant? (round your answer to the nearest metre.)

Question 8: One population has size $P_1(t)$ at time t years given by $P_1(t) = 1000e^{0.05t}$. A second population has size $P_2(t)$ at time t years given by $P_2(t) = 800e^{0.08t}$.

(a)[3 points] What is the doubling time of the first population? (round your answer to one decimal.)

(b)[3 points] How many years does it take the second population to reach 2500 in size? (round your answer to one decimal.)

(c)[4 points] At what time t will both populations be equal in size? (round your answer to one decimal.)

Question 9:

(a)[5 points] Solve for x:

$$\log_{10}(3x) - \log_{10}(x+1) = \log_{10} x \ .$$

(b)[5 points] Find all solutions $0 \le t < 2\pi$ to

$$2\sin^2(t) + \sin(t) - 1 = 0 \ .$$

Question 10 [10 points]: Solve the following system of equations **using matrix reduction** (no credit will be given for using any other method):

$$5x - 10y + 5z = -15$$
$$-5x + 8y - 7z = -5$$
$$10x - 18y + 13z = -3$$