Question 1:

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

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

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

Question 2:

(a)[3 points] Find all angles $0 \leq \theta < 2\pi$ such that $\sin\theta = \sqrt{3}/2$.

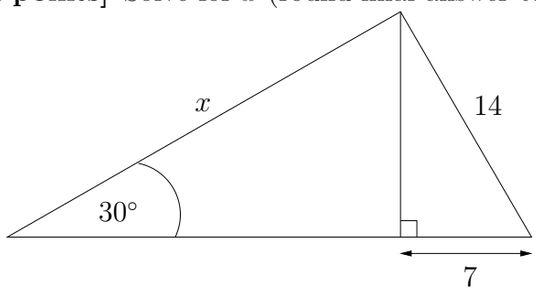
(b)[3 points] Find the exact value of $\sin(11\pi/12)$ (note: 2/3+1/4=11/12).

(c)[4 points] Simplify to an expression which does not contain trigonometric functions:

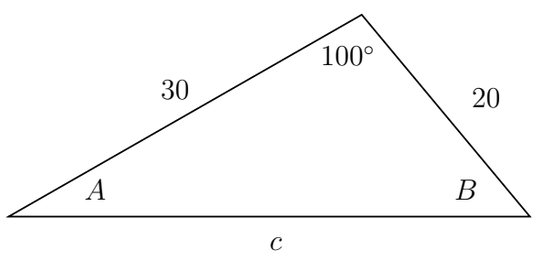
$$\sin(\arccos(x/2))$$

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 11^{th} term of the arithmetic sequence $\frac{7}{6}, \frac{5}{6}, \ldots$

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

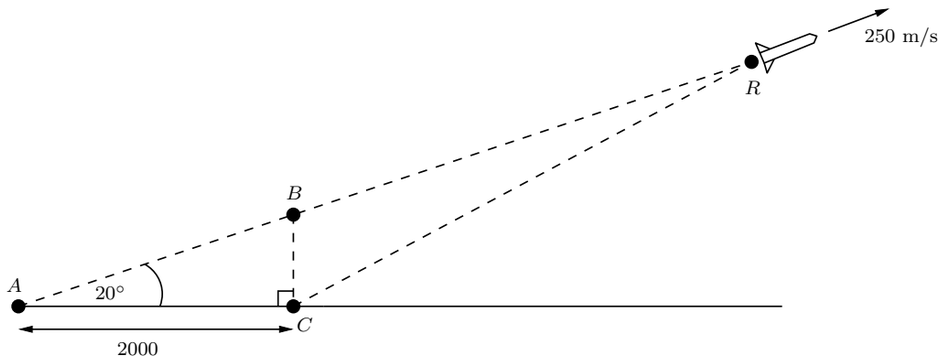
(c)[**4 points**] An arithmetic series has first term 7, last term -47 and common difference between terms of $d = -3$. Find the sum of the series.

Question 6:

(a)[**7 points**] Carefully sketch the graph of $f(x) = \frac{1}{2}\sin\left(2x - \frac{\pi}{2}\right) - \frac{1}{2}$ 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 $0 \leq t < 2\pi$ 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):

$$\begin{aligned} 5x - 10y + 5z &= -15 \\ -5x + 8y - 7z &= -5 \\ 10x - 18y + 13z &= -3 \end{aligned}$$

You may find some of the following formulas useful:

$$\sin^2(A) + \cos^2(A) = 1$$

$$\tan^2(A) + 1 = \sec^2(A)$$

$$1 + \cot^2(A) = \csc^2(A)$$

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

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

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

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

$$\sin(2A) = 2\sin(A)\cos(A)$$

$$\cos(2A) = \cos^2(A) - \sin^2(A)$$

$$\cos(2A) = 1 - 2\sin^2(A)$$

$$\cos(2A) = 2\cos^2(A) - 1$$

$$\sin^2(A/2) = \frac{1 - \cos(A)}{2} \qquad \cos^2(A/2) = \frac{1 + \cos(A)}{2}$$

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$

$$c^2 = a^2 + b^2 - 2ab\cos(C)$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a_n = a + (n-1)d \qquad a_n = ar^{n-1}$$

$$S_n = n\frac{(a_1 + a_n)}{2} \qquad S_n = \frac{n[2a + (n-1)d]}{2} \qquad S_n = \frac{a(1 - r^n)}{1 - r}$$