Some guidelines for Team Homework

• You must read and attempt the problems before meeting with your team. Even if you aren’t able to obtain all the answers, being prepared during the team meetings helps your group work more efficiently during the meeting.

• Don’t be discouraged if you cannot solve most of the problems on your own — this is perfectly normal. This is part of why you are being assigned to work on these assignments as a group; make sure to discuss your questions and ideas with your teammates.

• If your team is having trouble with a particular problem, try visiting the Math Lab (our math tutoring center in EH B860) with your teammates to get help.

• Make sure everyone is involved and no-one feels excluded during the meetings. If you have a tendency to speak a lot, make sure to make room for others to contribute as well. If you notice someone is being quiet, actively encourage them to contribute to the group.

• Ask your teammates to explain their reasoning behind their answers if you don’t understand it. Remember that all members of the team are responsible for this assignment, and everyone should be on board with what the team turns in.

• Write up your final solutions neatly, and make sure your explanations are clear and complete. Make sure you go over the Team Homework Tutorial on the course website:

  https://instruct.math.lsa.umich.edu/support/teamhomework/
1. Lily is a dog who goes on walks every day with G, her person. G wants to be able to predict how long it will take him to walk Lily. He finds the following to be true:

- It always takes 3.5 minutes to get ready to go for a walk.
- At first, Lily and G walk at a pace of 24 minutes per mile.
- After 0.8 miles, Lily gets impatient and speeds up, so that from that point forward, they walk at a pace of 20 minutes per mile.

Let \( T = g(m) \) be time it takes to walk Lily a distance of \( m \) miles, including the time it takes to get ready.

(a) Use the information above to find a piecewise-defined formula for \( g(m) \).

(b) Graph \( T = g(m) \), and give a reasonable domain and range. Is \( g(m) \) invertible?

(c) G usually walks Lily on one of two routes: one is 0.6 miles, and the other is 1.2 miles. How long does each route take?

(d) If G has an hour to walk Lily, how far can they walk?

(e) After walking, Lily eats her breakfast. The longer she has walked, the faster she eats. If she walks for \( T \) minutes, it takes her \( S = c(T) \) seconds to eat her breakfast. For each of the following expressions, first decide if it make sense in the context of the problem. If it does not, explain why not. If it does, give a practical interpretation of the expression.

(i) \( c(g(1.2)) \)
(ii) \( g(c(20)) \)
(iii) \( c^{-1}(240) > 1.5 \)

2. In construction, many arches are built in the shape of a parabola. Suppose a symmetrical doorway is built with a parabolic arch on top, so that the height of the doorway \( d \) feet from the left side is given by \( h(d) = -1.5d^2 + 3.75d + 5.5 \).

(a) Use the method of completing the square to write the formula for \( h(d) \) in vertex form. Carefully show your algebraic work step-by-step.

(b) Find the height of the arch at its highest point, and the width of the doorway (remember that the doorway is symmetrical).

(c) A mover wants to push an awkwardly-shaped box that is 7 feet tall and 1 foot wide through the door. The box contents are fragile, so the box cannot be put at an angle or on its side. Will the box fit through the doorway?
3. The functions $f(x)$, $g(t)$, $h(s)$, and $k(u)$ are given below. Note that $f(x)$ is linear on the interval $[-4, 1)$.

\[
\begin{array}{c|c|c|c|c|c}
  t & -2 & -1 & 0 & 2 & 3 \\
  g(t) & -4 & 0 & 2 & -1 & -3 \\
  h(s) & f(s - 2) \\
  k(u) & \sqrt{u + 3} \\
\end{array}
\]

(a) Could $g(t)$ be concave up on the interval $[-2, 3]$? Could it be concave down on that interval?

(b) Which of the four functions could be invertible?

(c) Find the following values, if possible.
   
   (i) \( k^{-1}(g(0)) \)
   
   (ii) \( k(g(f(2) + 2)) \)
   
   (iii) \( h(g^{-1}(-1) + 1) \)

(d) Find all values of $x$ so that $k^{-1}(g(f(x))) = 1$. If you can find a solution in exact form, do so; otherwise, give an estimate.