Homework Assignment 7: Due at the beginning of class 10/5/01

A basic diving computer (see Figure 1[1]) incorporates a depth gauge and a clock. The computer measures the depth of the dive, and the amount of time that the person remains underwater.

Figure 1: "Aladin Sport" wrist-top dive computer manufactured by UWATEC. (a) The dive computer, (b) screen showing maximum depth (feet) and time submerged (3 minutes), and (c) after the dive, the computer displays the amount of time before the diver can fly in an airplane (9 hours) and the amount of time to completely rid the diver's body of dissolved gases (28 hours and 29 minutes).

Diving computers have become popular among SCUBA enthusiasts as they can help divers to avoid painful and life-threatening "decompression sickness" (also called "DCS" or "the bends"). DCS can occur when a diver swims to the surface too quickly after a deep dive, or when a diver flies in an airplane too soon after a dive. To help prevent DCS, the Divers Alert Network[2] suggests a minimum wait of 12 hours between a single dive and flying, and a 24 hour wait between multiple dives and flying. Similarly, the U.S. Coast Guard[3] recommends a wait of at least twelve hours between diving and flying.

If you always dive to the same depth (e.g. 65 feet) then the amount of time that a diving computer will tell you to wait between diving and flying depends on how much time you spent underwater. For example, if you spent t minutes underwater, you could express the number of hours that the computer thinks you should wait as $W(t)$.

In questions 1,2 and 3 express the number of hours that you will have to wait as a symbolic statement using t, $W(t)$, numbers, +, -, *, ÷ etc.

1. I was supposed to be underwater for t minutes, but a large tiger shark appeared in the area. I had to hide on the bottom for an extra fifteen minutes until the shark swam away.

2. I know that my body takes longer to adapt than average, so if I spend t minutes underwater, my actual wait time will be 3 hours longer than the prediction of the computer.

3. I was supposed to spend t minutes underwater but cut it short by five minutes. As I was breathing a special blend of gases instead of compressed air, my wait time was two hours less than the prediction of the computer.

---

[1] Image source: http://www.uwatec.com/

[2] http://www.dan.ycg.org/

[3] Source: U.S. Coast Guard Boat Crew Seamanship Manual, 1998. (COMDTINST M16798.27)

4. Suppose that the computer prediction of your wait time is M hours. Express the number of minutes that you spent underwater as a collection of symbols such as t, $W(t)$, numbers, +, -, *, ÷ etc.

Carbon-14 dating is an important method for establishing the age of artifacts and fossils in the fields of archaeology and paleontology. Technicians at a laboratory measure the amount, c, of carbon-14 present in an artifact, and obtain the age, A, by plugging c into the function $A = f(c)$. Question 5 refers to this situation.

5. Match the stories (**(a)-(e)**) with the algebraic expressions below.

(a) An ancient shroud was partially burnt, doubling the amount of carbon-14 in it.

(b) A recently hired employee did their sums wrong and got twice the actual age of an urn.

(c) The janitor used an antique bowl for an ashtray, and did not clean it properly, increasing the amount of carbon-14 present.

(d) The carbon-14 measuring machine was poorly calibrated, and its readings were 25% off.

(e) A professor does not accept the laboratory's results, believing a relic to be far older. He publishes his opinion as the age of the relic.

(I) $f(c) + 1000$

(II) $2*f(c)$

(III) $f(0.75*c)$

(IV) $f(2c)$

(V) $f(c + 1)$