HW 15.3 # 3,7,14,27,35,42,50,57,70ab, 78, 85

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MATH 32A Section 1A

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3. The wind-chill index W is the perceived temperature when the actual temperature is T and the wind speed is v, so we can write $W = f(T, v)$. The following table of values is an excerpt from Table 1 in Section 14.1.

Wind speed (km/h)

Actual temperature (°C) T \ v	20	30	40	50	60	70
−10	−18	−20	−21	−22	−23	−23
−15	−24	−26	−27	−29	−30	−30
−20	−30	−33	−34	−35	−36	−37
−25	−37	−39	−41	−42	−43	−44

(a) Estimate the values of $f_T(-15, 30)$ and $f_v(-15, 30)$. What are the practical interpretations of these values?

(b) In general, what can you say about the signs of $\partial W/\partial T$ and $\partial W/\partial v$?

(c) What appears to be the value of the following limit?

$$\lim_{v \to \infty} \frac{\partial W}{\partial v}$$

a) $f_T(-15, 30)$

$$\lim_{h \to 0} \frac{f(-15+h, 30) - f(-15, 30)}{h} \qquad \text{let } h = 5$$

$$\lim_{h \to 0} \frac{f(-10, 30) - f(-15, 30)}{5}$$

$$\lim_{h \to 0} \frac{-20 + 26}{5} = \boxed{\frac{6}{5}}$$

$$f_v(-15, 30) = \lim_{h \to 0} \frac{f(-15, 30+h) - f(-15, 30)}{h}$$

$$\lim_{h \to 0} \frac{f(-15, 35) - f(-15, 30)}{5} = \frac{-26.5 + 26}{5} = \frac{.5}{5} = \boxed{\frac{1}{10}}$$

For f_t, as the actual temperature decreases, the perceived temperature decreases at a rate of 6/5
For f_v as the wind speed increases, the perceived temperature decreases at a rate of 1/10.

b) $\frac{\partial W}{\partial T}$ is positive

$\frac{\partial W}{\partial v}$ is negative

c) $\lim_{v \to \infty} \frac{\partial W}{\partial v} = 0$

7. The following surfaces, labeled a, b, and c, are graphs of a function f and its partial derivatives f_x and f_y. Identify each surface and give reasons for your choices.