1. a) $x > 0$

b) $-\infty$

c) $-\infty$

d) $x = \frac{e^x \pm \sqrt{e^x - 8}}{2}$

e) No

f) $x = \frac{e^x - \sqrt{e^x - 8}}{2}$

g) Yes at $x = 9$.

h) $y = (2 - \ln(3))(x - 1) + 3$

i) $(f^{-1})'(3) = \frac{1}{2 - \ln 3}$ (simplified)

j) Yes

k) No

l) $f''(x) = \frac{2 - x^2}{x(x^2 + 2)}$

m) 0

n) $x = \sqrt{2}$

o) $0 < x < \sqrt{2}$

p) It would be an underestimate. We know $f$ is concave up on the interval containing $x = 1.2$ (see above), so the $y$-values on the tangent line would be smaller than the actual $y$-values on $f$.

q) $f(7) - f(1) = 3.059$

r) $\ln\left(\frac{5}{27}\right) - \ln\left(\frac{3}{11}\right)$
\( s) \quad f(5) = \int_1^5 f'(x) \, dx + 3 \approx 5.7442 \)

\( t) \quad \text{It would be an overestimate because } f' \text{ is decreasing on this interval.} \)

\( u) \quad \text{It would be an underestimate because } f \text{ is increasing on this interval.} \)

\( v) \quad h'(x) = \ln \left( \frac{x}{x^2 + 2} \right) + 2. \)

\( w) \quad g'(x) = 3 \left( f(x) \right)^2 \cdot f'(x) \quad g'(7) = 3(6.059)^2 (\ln(7/51) + 2). \)

\( x) \quad \text{Approximately 0.7 degrees per hour. Between the 3rd and 4th hours, the temperature would increase} \)
\( \text{by approximately 0.7 degrees.} \)

\( y) \quad \text{The change in temperature in degrees between the 1st and 4th hours.} \)