```
end
xr = xl;
for i = 1:11
  xrold = xr;
  xr = (xl + xu)/2;
  if xr ~= 0, ea = abs((xr - xrold)/xr) * 100; end
  test = fTa(xl,osf)*fTa(xr,osf);
  if test < 0
    xu = xr;
  elseif test > 0
    xl = xr;
  else
    ea = 0;
  end
end
TC = xr - 273.15;
end

function f = fTa(Ta, osf)
f = -139.34411 + 1.575701e5/Ta - 6.642308e7/Ta^2;
f = f + 1.2438e10/Ta^3 - 8.621949e11/Ta^4;
f = f - log(osf);
```

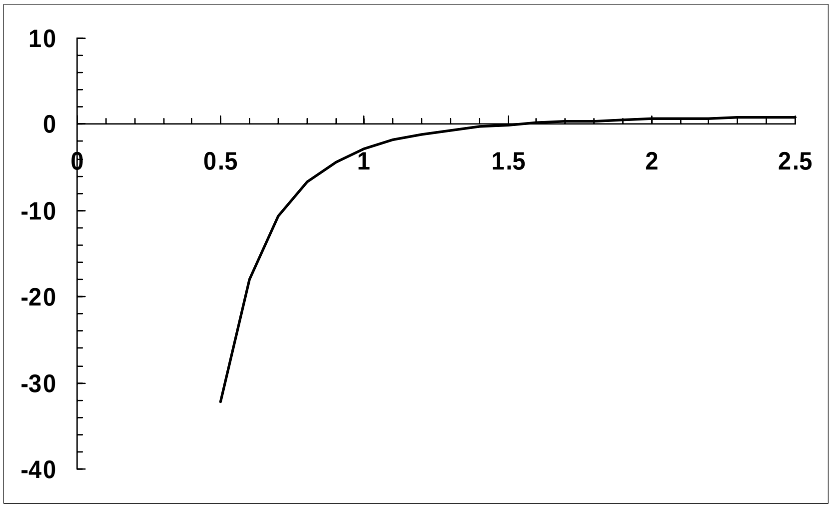
The function can be used to evaluate the test cases:

```
>> TempEval(8)

ans =
   26.7798

>> TempEval(10)

ans =
   15.3979

>> TempEval(14)

ans =
    1.5552
```

5.10 (a) The function to be evaluated is

$$f(y) = 1 - \frac{400}{9.81(3y + y^2/2)^3}(3 + y)$$

A graph of the function indicates a positive real root at approximately 1.5.



(b) Using bisection, the first iteration is

$$x_r = \frac{0.5 + 2.5}{2} = 1.5$$

$$f(0.5)\,f(1.5) = -32.2582(-0.030946) = 0.998263$$

Therefore, the root is in the second interval and the lower guess is redefined as x_l = 1.5. The second iteration is

$$x_r = \frac{1.5 + 2.5}{2} = 2$$

$$\varepsilon_a = \left|\frac{2 - 1.5}{2}\right| 100\% = 25\%$$

$$f(1.5)\,f(2) = -0.030946(0.601809) = -0.018624$$

Therefore, the root is in the first interval and the upper guess is redefined as x_u = 2. The remainder of the iterations are displayed in the following table:

i	x_l	$f(x_l)$	x_u	$f(x_u)$	x_r	$f(x_r)$	$\lvert\varepsilon_a\rvert$
1	0.5	–32.2582	2.5	0.813032	1.5	–0.030946	
2	1.5	–0.03095	2.5	0.813032	2	0.601809	25.00%
3	1.5	–0.03095	2	0.601809	1.75	0.378909	14.29%
4	1.5	–0.03095	1.75	0.378909	1.625	0.206927	7.69%
5	1.5	–0.03095	1.625	0.206927	1.5625	0.097956	4.00%
6	1.5	–0.03095	1.5625	0.097956	1.53125	0.036261	2.04%
7	1.5	–0.03095	1.53125	0.036261	1.515625	0.003383	1.03%
8	1.5	–0.03095	1.515625	0.003383	1.5078125	–0.013595	0.52%

After eight iterations, we obtain a root estimate of **1.5078125** with an approximate error of 0.52%.

(c) Using false position, the first iteration is

$$x_r = 2.5 - \frac{0.81303(0.5 - 2.5)}{-32.2582 - 0.81303} = 2.45083$$

$$f(0.5)\, f(2.45083) = -32.25821(0.79987) = -25.80248$$

Therefore, the root is in the first interval and the upper guess is redefined as x_u = 2.45083. The second iteration is

$$x_r = 2.45083 - \frac{0.79987(0.5 - 2.45083)}{-32.25821 - 0.79987} = 2.40363$$

$$\varepsilon_a = \left| \frac{2.40363 - 2.45083}{2.40363} \right| 100\% = 1.96\%$$

$$f(0.5)\, f(2.40363) = -32.2582(0.78612) = -25.35893$$

The root is in the first interval and the upper guess is redefined as x_u = 2.40363. The remainder of the iterations are displayed in the following table:

i	x_l	$f(x_l)$	x_u	$f(x_u)$	x_r	$f(x_r)$	$\lvert\varepsilon_a\rvert$
1	0.5	–32.2582	2.50000	0.81303	2.45083	0.79987	
2	0.5	–32.2582	2.45083	0.79987	2.40363	0.78612	1.96%
3	0.5	–32.2582	2.40363	0.78612	2.35834	0.77179	1.92%
4	0.5	–32.2582	2.35834	0.77179	2.31492	0.75689	1.88%
5	0.5	–32.2582	2.31492	0.75689	2.27331	0.74145	1.83%
6	0.5	–32.2582	2.27331	0.74145	2.23347	0.72547	1.78%
7	0.5	–32.2582	2.23347	0.72547	2.19534	0.70900	1.74%
8	0.5	–32.2582	2.19534	0.70900	2.15888	0.69206	1.69%
9	0.5	–32.2582	2.15888	0.69206	2.12404	0.67469	1.64%
10	0.5	–32.2582	2.12404	0.67469	2.09077	0.65693	1.59%

After ten iterations we obtain a root estimate of **2.09077** with an approximate error of 1.59%. Thus, after ten iterations, the false position method is converging at a very slow pace and is still far from the root in the vicinity of 1.5 that we detected graphically.

Discussion: This is a classic example of a case where false position performs poorly and is inferior to bisection. Insight into these results can be gained by examining the plot that was developed in part **(a)**. This function violates the premise upon which false position was based–that is, if $f(x_u)$ is much closer to zero than $f(x_l)$, then the root is closer to x_u than to x_l (recall Fig. 5.8). Because of the shape of the present function, the opposite is true.