Revisions are shown in red.

Question 5, p. 9
Given the function \( f(x) = \frac{1}{x - 2} \), the linear approximation of \( f(x) \) around \( x = -1 \) is most nearly:

Question 50, p. 27
A system is designed to allow at least 10,000 Btu/min of heat to be transferred \( (Q) \) from the system to the air as air flows through it. The system can be operated so that air \( (c_p = 0.26 \text{ Btu/lb-F}) \) flowing at 500 lb/min will exit at 100°F. The minimum temperature \( (^\circ \text{F}) \) the air can enter the system is ________________.

Question 68, p. 36
Match the treatment technology that will best achieve the treatment objective for the potable reuse of water. Use each technology only once.

<table>
<thead>
<tr>
<th>Treatment Objective</th>
<th>Treatment Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Remove suspended solids</td>
<td>1. UV/H(_2)O(_2)</td>
</tr>
<tr>
<td>B. Reduce dissolved nutrients</td>
<td>2. Media filtration</td>
</tr>
<tr>
<td>C. Degrade trace organics</td>
<td>3. Biologically active filtration</td>
</tr>
</tbody>
</table>

Solutions Table, p. 52
50: The correct answer is: 23 to 24°F
Solution 24, p. 63
Refer to the *FE Reference Handbook*, Environmental Engineering chapter, Steady-State Reactor Parameters.

\[ C_t = C_0[e^{-kt}] \]

Given: \( k = 0.1 \text{ min}^{-1} \)
\[ \theta = 1 \text{ hour} = 60 \text{ min} \]

Let \( C_0 = 100\% \)

\[ C_t = 100\% [e^{-0.1 \text{ min}^{-1} \times 60 \text{ min}}] = 100\% [e^{-6}] = 100\% (0.00248) = 0.248\% \]

Removal efficiency, \( \eta = 100\% - 0.248\% = 99.752\% \), which is most nearly 99.9\%.

**THE CORRECT ANSWER IS: C**

Solution 25, p. 64
Refer to the Cylindrical Pressure Vessel section in the Mechanics of Materials chapter of the *FE Reference Handbook*.

The cylinder can be considered thin-walled if \( \frac{t}{d_i} \leq 0.10 \). In this case, \( t = 12 \text{ mm} \) and \( d_i = 700 \text{ mm} \).

Since \( \frac{t}{d_i} = \frac{12}{350} = 0.034 \) which is \( \leq 0.10 \), the pipe is thin-walled.

Thus \( \sigma_t = \frac{Pr}{t} \)

where \( r = \frac{\eta + r_o}{2} = \frac{350 + 362}{2} = 356 \text{ mm} \)

\[ \sigma_t = \frac{1.680 \text{ MPa}(356 \text{ mm})}{12 \text{ mm}} = 49.8 \text{ MPa} \]

**THE CORRECT ANSWER IS: B**
Solution 50, p. 75

Refer to the Compressors section in the Fluid Mechanics chapter of the FE Reference Handbook.

\[ Q = m \, c_p \, (T_2 - T_1) \]

Solve for \( T_1 \)

\[-T_1 = \left[ \frac{Q}{m \, c_p} \right] - T_2\]

\[ T_1 = T_2 - \left[ \frac{Q}{m \, c_p} \right] \]

Substitute and solve

\[ T_1 = 100^\circ F - \left[ \frac{10,000 \text{ Btu/min}}{(500 \text{ lb/min})(0.26 \text{ Btu/lb-}^\circ \text{F})} \right] \]

\[ T_1 = 100^\circ F - (76.9^\circ F) \]

\[ T_1 = 23.1^\circ F \]

Since the negative is showing a loss of heat, the initial temperature = 669°F.

THE CORRECT ANSWER IS: 23°F to 24°F

Solution 68, p. 82

Examinees are expected to be familiar with various treatment technologies.

<table>
<thead>
<tr>
<th>Treatment Objective</th>
<th>Treatment Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Remove suspended solids</td>
<td>2. Media filtration</td>
</tr>
<tr>
<td>B. Reduce dissolved nutrients</td>
<td>3. Biologically active filtration</td>
</tr>
<tr>
<td>C. Degrade trace organics</td>
<td>1. UV/H₂O₂</td>
</tr>
</tbody>
</table>
Solution 56, p. 78

Refer to the Streeter Phelps equation in the Stream Modeling section in the Environmental Engineering chapter of the \textit{FE Reference Handbook}.

\[
t_c = \frac{1}{k_r - k_d} \ln \left[ \frac{k_r}{k_d} \left( 1 - D_a \frac{k_r - k_d}{k_d L_a} \right) \right]
\]

\[
D = \frac{k_d L_a}{k_r - k_d} \left[ \exp(-k_d t) - \exp(-k_r t) \right] + D_a \exp(-k_r t)
\]

\[
DO = DO_{sat} - D
\]

From the question statement:

\( k_r = 0.4 \text{ day}^{-1} \)
\( k_d = 0.2 \text{ day}^{-1} \)
\( D_a = DO_{sat} - DO_{initial} = 9.2 - 7.0 = 2.2 \text{ mg/L} \)
\( L_a = 15 \text{ mg/L} \)

\( t_c = 2.67 \text{ days} \)
\( D_{tc} = 4.39 \text{ mg/L} \)
\( DO = DO_{sat} - D_{tc} = 9.2 - 4.39 = 4.8 \text{ mg/L} \)

\textbf{THE CORRECT ANSWER IS: C}