Work for problem 6(a)

$$\int_0^3 \frac{1}{\sqrt{x+1}} \, dx + \int_3^5 (5-x) \, dx$$

$$= \left[ \frac{2}{3}(x+1)^{3/2} \right]_0^3 + \left[ 5x - \frac{1}{2}x^2 \right]_3^5$$

$$= \frac{2}{3}(4)^{3/2} - \frac{2}{3} + 25 - \frac{1}{2} \cdot 25 - (15 \frac{1}{2})$$

$$= \frac{2}{3} \cdot 8 \frac{2}{3} + 10 - \frac{16}{2}$$

$$= \frac{16}{15} - \frac{2}{15} + 2 - \frac{8}{5}$$

$$= \frac{14}{15} + 1 - \frac{8}{5}$$

yes, $f(3)$ is 2, which is the same as the limits as $x$ approaches 3 from either side.

Work for problem 6(b)

$$\int_0^3 \frac{1}{\sqrt{x+1}} \, dx + \int_3^5 (5-x) \, dx$$

$$= \frac{14}{15} + \frac{20}{15} - \frac{24}{5}$$

$$= \frac{4}{3}$$

Continue problem 6 on page 15.
Work for problem 6(c)

\[ q' = \frac{k}{an^{x+1}} \]

\[ \frac{m}{k} = \frac{1}{3n^{x+1}} = m \]

\[ k \cdot \frac{1}{3n^{x+1}} = m \]

slopes must be equal at 3

functions must be equal at 3

\[ k(2) = m(3) + 2 \]

\[ \frac{1}{4} \left( \frac{8}{5} \right) = \frac{8}{50} = \frac{2}{5} \]

\[ \frac{m}{k} = \frac{1}{3} \]

\[ m = \frac{1}{3} k - 2 \]

\[ \frac{1}{4} \left( \frac{8}{5} \right) = \frac{2}{3} k - 2 \]

\[ k = \frac{8}{3} \]

\[ k = \frac{8}{3} - \frac{8}{3} \]

\[ -\frac{8}{3} = -\frac{8}{3} \]

\[ k = \frac{24}{15} = \frac{8}{5} \]

k = \frac{8}{5}, m = \frac{1}{5}

END OF EXAMINATION

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Work for problem 6(a)

\[ f(x) = \begin{cases} 
\sqrt{x+1} & 0 \leq x \leq 3 \\
5 - x & 3 < x \leq 5 
\end{cases} \]

\[ f(3) = \begin{cases} 
\sqrt{3+1} = \sqrt{4} = 2 \\
5 - 3 = 2 
\end{cases} \]

f is continuous at \( x = 3 \) because the limit \( \lim_{x \to 3} f(x) = 2 \) and \( f(3) = 2 \).

Work for problem 6(b)

The average value is \( \frac{4}{3} \) on \( 0 \leq x \leq 5 \).

\[
\text{Average value} = \frac{1}{5 - 0} \int_0^5 f(x) \, dx
\]

\[
= \frac{1}{5} \left( \int_0^3 \sqrt{x+1} \, dx + \int_3^5 (5 - x) \, dx \right)
\]

\[
= \frac{1}{5} \left( \left. \frac{2}{3} (x+1)^{3/2} \right|_0^3 + \left. 5x - \frac{1}{2}x^2 \right|_3^5 \right)
\]

\[
= \frac{1}{5} \left( \left( \frac{2}{3} (4)^{3/2} - \frac{2}{3} (1)^{3/2} \right) + \left( (5(5) - \frac{1}{2} (5)^2) - \left( \frac{1}{2} (3)^2 \right) \right) \right)
\]

\[
= \frac{1}{5} \left( \left( \frac{2}{3} (8) - \frac{2}{3} \right) + \left( (25 - \frac{25}{2}) - \left( \frac{9}{2} \right) \right) \right)
\]

\[
= \frac{1}{5} \left( \left( \frac{16}{3} - \frac{2}{3} \right) + \left( \frac{30}{2} - \frac{9}{2} \right) \right)
\]

\[
= \frac{1}{5} \left( \frac{14}{3} + \frac{21}{2} \right)
\]

Continue problem 6 on page 15.
Work for problem 6(c)

\[ g(x) = \begin{cases} \sqrt{x+1} & 0 \leq x \leq 3 \\ \frac{3m+2}{2} & 3 \leq x \leq 5 \end{cases} \]

\[ g(3) = \frac{3m+2}{2} \]

\[ 2k = \frac{3m+2}{2} \]

\[ k = \frac{3m+2}{2} \]

\[ \frac{3m+2}{2} + x + 1 = 0 \]

\[ \frac{3m+2}{2} - \frac{1}{3+1} = 0 \]

\[ \frac{3m+2}{2} - \frac{1}{4} = 0 \]

\[ \frac{3m+2}{2} (2) = 0 \]

\[ 3m+2 = 0 \]

\[ m = -\frac{2}{3} \]

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