

Quiz 10 will cover the following topics: all topics from Quiz 1-9, Exams 1, 2, and definite integrals (5.3).

Review Problems

1. Differentiate each of the following functions.

a) $f(x) = 5^{3x^2-2}$	f) $f(x) = \frac{e^{-x^2}}{5x^2-1}$	k) $f(x) = -\frac{1}{9}e^{-3x} - \frac{1}{3}xe^{-3x}$
b) $f(x) = (x+3)^{100}(2-x)^5$	g) $f(x) = x^3 - 4^x + e^3$	l) $f(x) = \log_5 \sqrt{5x^6 - 6x + \frac{1}{x}}$
c) $f(x) = 2^x + x^2$	h) $f(x) = e^x + e^{-x}$	m) $f(x) = 3^{\sqrt{x^8-3x^4+1}}$
d) $f(x) = 3^{x-1} + (x-1)^3$	i) $f(x) = e^x - e^{-x}$	n) $f(x) = \frac{2x^2-1}{x^2+3}$
e) $f(x) = \frac{\sqrt{x^3-5x+1}}{x^2-5}$	j) $f(x) = 5^{2x} - 5^{-2x}$	o) $f(x) = \frac{e^x}{e^x+1}$

2. Compute each of the following definite integrals.

a) $\int_{-5}^5 (4x^3 - x) dx$	e) $\int_0^2 e^{-2x} dx$	i) $\int_0^2 e^{-3x} dx$
b) $\int_1^3 \frac{1}{x^3} dx$	f) $\int_4^8 \frac{1}{(x+2)^2} dx$	j) $\int_{-5}^5 \frac{1}{x} dx$
c) $\int_1^5 (2^x - 3) dx$	g) $\int_0^4 \sqrt{x^3} dx$	k) $\int_0^{\ln 8} e^x - e^{-x} dx$
d) $\int_6^8 \frac{1}{x-5} dx$	h) $\int_0^{100} e^{-x} dx$	

3. An object's velocity function is $v(t) = t^2 - t + 5$. Find the average velocity of the object on the interval between $t = 0$ and $t = 6$.

Review Problems - Answers

1. a) $f'(x) = 6x(\ln 5)5^{3x^2-2}$ b) $f'(x) = 5(x+3)^{99}(2-x)^4(-21x+37)$ c) $f'(x) = 2^x \cdot \ln 2 + 2x$

d) $f'(x) = 3^{x-1} \ln 3 + 3(x-1)^2$ e) $f'(x) = \frac{(3x^2-5)(x^2-5)}{2\sqrt{x^3-5x+1}} - \frac{\sqrt{x^3-5x+1}(2x)}{(x^2-5)^2}$

f) $f'(x) = -2xe^{-x^2} \frac{5x^2+4}{(5x^2-1)^2}$ g) $f'(x) = 3x^2 - (\ln 4)4^x$ h) $f'(x) = e^x - e^{-x}$

i) $f'(x) = e^x + e^{-x}$ j) $f'(x) = 2 \ln 5 (5^{2x} + 5^{-2x})$ k) $f'(x) = xe^{-3x}$

l) $f'(x) = \frac{30x^5 - \frac{1}{x^2} - 6}{2(\ln 5) \left(\frac{1}{x} - 6x + 5x^6 \right)}$ m) $f'(x) = 3^{\sqrt{x^8-3x^4+1}} \cdot \ln 3 \cdot \frac{8x^7 - 12x^3}{2\sqrt{x^8-3x^4+1}}$

n) $f'(x) = \frac{14x}{(x^2+3)^2}$ o) $f'(x) = \frac{e^x}{(e^x+1)^2}$

2. a) 0 b) $\frac{4}{9}$ c) $\frac{30}{\ln 2} - 12$ d) $\ln 3$ e) $\frac{1}{2} - \frac{1}{2e^4}$ f) $\frac{1}{15}$ g) $\frac{64}{5}$

h) $1 - \frac{1}{e^{100}}$ i) $\frac{1}{3} - \frac{1}{3}e^{-6} \cong 0.33251$ j) undefined k) $\frac{49}{8}$

3. 14.

Solution:

$$\begin{aligned} v_{\text{average}} &= \frac{\text{distance traveled}}{\text{time}} = \frac{\int_0^6 v(t) dt}{6} = \frac{1}{6} \int_0^6 t^2 - t + 5 dt = \frac{1}{6} \left(\frac{t^3}{3} - \frac{t^2}{2} + 5t \Big|_0^6 \right) \\ &= \frac{1}{6} \left(\frac{6^3}{3} - \frac{6^2}{2} + 5(6) \right) - \frac{1}{6} \left(\frac{0^3}{3} - \frac{0^2}{2} + 5(0) \right) = \frac{1}{6} (72 - 18 + 30) = \frac{1}{6} (84) = 14 \end{aligned}$$