

Exercises on Trigonometric Functions

October 2, 2014

1. Compute the following quantities.

(a) $\sin(\pi/3)$

(b) $\cos(\pi/4)$

(c) $\tan(\pi/6)$

(d) $\sin\left(\frac{3\pi}{2}\right)$

(e) $\cos\left(\frac{5\pi}{8}\right)$

(f) $\tan\left(\frac{7\pi}{8}\right)$

(g) $\sin\left(\frac{2\pi}{3}\right)$

(h) $\cos\left(-\frac{3\pi}{2}\right)$

(i) $\tan(-6\pi)$

(j) $\sin\left(-\frac{47\pi}{2}\right)$

2. Show that

$$\frac{d}{dx}(\tan(x)) = \frac{1}{\cos^2(x)}$$

by completing the following steps:

- (a) Explain why we can write

$$\tan(x) = \frac{\sin(x)}{\cos(x)}.$$

- (b) Apply the quotient rule to the fraction obtained in part (a).
(c) Use the fact that, for any x , we always have $\sin^2(x) + \cos^2(x) = 1$ to simplify the result from part (b).

3. Compute the derivatives of the following functions.

- (a) $x^5 + 2 \sin x$
(b) $x \cos x$
(c) $\tan(x^2 - 1)$
(d) $\ln(2 + \cos(x))$
(e) $\sin(\sin(x))$
(f) $\frac{\sin(x)}{x}$
(g) $\frac{\sin(\ln(x))}{x}$

4. Compute the following indefinite integrals.

- (a) $\int x + \sin(x) \, dx$
(b) $\int x^5 + \frac{5}{x^5} + \frac{2}{\cos^2(x)} \, dx$
(c) $\int \frac{1}{4}x^3 + 10e^x + 2 \sin(x) \, dx$
(d) $\int \sqrt[3]{x} - 2xe^{x^2} + 4 \sin(2x) \, dx$
(e) $\int \cos(2x) - \frac{2x}{\cos^2(x^2)} \, dx$
(f) $\int \sin(x)e^{\cos(x)} - x^3 \cos(x^4) \, dx$
(g) $\int xe^x - 2x \cos(x) \, dx$

(h) $\int \frac{1}{x} + x^2 e^x + x \sin(2x) \, dx$

(i) $\int x \ln(x) + 2x^2 \cos(2x) \, dx$

5. Compute the following definite integrals.

(a) $\int_0^{\pi/2} x + \sin(x) \, dx$

(b) $\int_{\pi/2}^{3\pi/2} \cos(x) e^{\sin(x)} \, dx$

(c) $\int_0^{\pi} x \sin(x) \, dx$