MATH 110 Problem Set 2.5

Edward Doolittle

Tuesday, February 10, 2026

The following problems based on Section 2.5 of the textbook will help you study. *You do not need to hand in solutions to these problems.*

1. (Based on 2.5.7–46) Find the derivatives of the following functions.

   (a) $g(x) = (5x + x^3)^7$ (b) $H(t) = t^2 \cos kt$ (c) $(1+2z)^{10}(3-2z)^8$ (d) $W(t) = \sqrt{\dfrac{t}{t^2+4}}$

2. (Based on 2.5.51–54) Find an equation of the tangent line to the curve $y = x\sin(3x - \pi)$ at the point $(\pi/2, \pi/2)$ on the curve. Also find an equation of the normal line to that curve at the given point.

3. (Based on 2.5.47–50) Find the second derivative of the function $y = x^2 \cos 3x$

4. (Based on 2.5.59) Find all points on the graph of the curve $y = 2\sin x + \sin^2 x$ where the graph is horizontal (i.e., where it has a horizontal tangent).

5. (Based on 2.5.61–62) If $F(x) = f(g(x))$ where $f(-1) = 3$, $f'(-1) = 4$, $g(2) = -1$, and $g'(2) = 5$, find $F'(2)$

6. (Based on 2.5.70) If $f(x) = xg(x^2)$, find $f''(x)$ in terms of g, g', and g''.

7. (Based on 2.4.53) Show that the function

   $$y = A\sin 2t + B\cos 2t$$

   satisfies the equation

   $$y'' + 4y = 0$$

8. (Based on 2.5.73–74) Find the 23rd derivative of $y = \cos 2x$.

9. (Based on 2.5.78) The number of hours of daylight in Regina on day t of the year (counting from January 1 which is day 1) is given (approximately) by the formula

   $$L(t) = 12 + 4.25\sin\left[\frac{2\pi}{365}(t - 80)\right]$$

   At what rate is the number of hours of daylight changing on April 1, on June 21, and on December 1? (Assume that the current year has 365 days.)

10. (Based on 2.5.87) Recall that $\cos\theta$ is the cosine of an angle as a function of the measure θ of the angle in radians. Let $\cos^\circ t$ be the cosine of an angle as a function of the measure t of the angle in degrees.

    (a) What is the relationship between the measure θ of an angle in radians and the measure t of the same angle in degrees?

    (b) Write $\cos^\circ$ in terms of cos

(c) Find $\frac{d}{dt}\cos^\circ t$. (Note that the answer is somewhat more complicated than $\frac{d}{d\theta}\cos\theta$. That is one of the reasons why we use radian measure rather than degree measure for angles in calculus.)

You may find the following additional exercises from Section 2.5 helpful.

2.5 C-level: 1–6, 7–46, 47–50, 51–54, 55–57, 59–60, 61–64, 67–68, 69–72
B-level: 58, 65–66, 73–74, 75–76, 77–80
A-level: 83–90