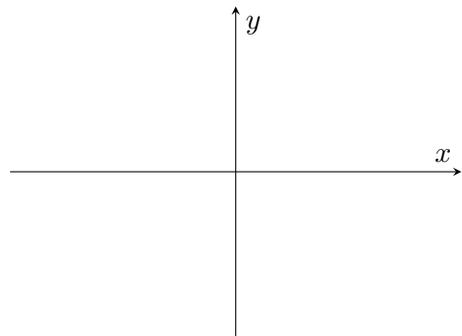**Mark:** $\overline{}$
25

MATH 100 (Winter, 2026)
Test 1

1. (2 marks) Find the equation of the line, in general form, that passes through the point $(-3, 2)$ and is perpendicular to the line $x + y = 7$.

2. (2 marks) Sketch the graph of the function $f(x) = \sqrt{9 - x^2}$ and state its domain and range using interval notation.
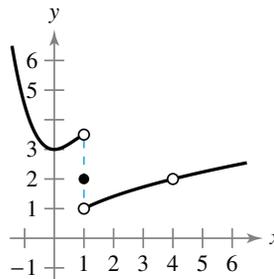
Domain = _____

Range = _____

3. (2 marks) Solve the equation $\cos^2 \theta + \sin \theta = 1$ for θ, where $0 \le \theta \le 2\pi$.

4. (1 mark) Given the graph of the function $f(x)$, evaluate the following limits. Answer "dne" if the limit does not exist.

$$\lim_{x \to 1} f(x) = \underline{\hspace{3cm}}$$

$$\lim_{x \to 4} f(x) = \underline{\hspace{3cm}}$$

5. Evaluate the limits. If they do not exist, then determine whether they are ∞, $-\infty$ or neither.

(a) (2 marks) $\displaystyle \lim_{x \to 4} \frac{\sqrt{x+5} - 3}{x - 4}$

(b) (1 mark) $\displaystyle \lim_{x \to (1/2)^-} x \sec \pi x$

6. (3 marks) Verify that the Intermediate Value Theorem applies to $f(x) = x^2 + x - 1$ on the interval $[0, 5]$ for $k = 11$, and then find the value of c in the interval satisfying $f(c) = k$ guaranteed by the theorem.

7. (3 marks) Use the **limit definition** of a derivative to find $f'(x)$, where $f(x) = \dfrac{1}{x-1}$.

8. Find and simplify the derivatives of the following functions.

    (a) (1 mark) $f(t) = t^2 \sin t$

    (b) (3 marks) $y = \dfrac{x}{\sqrt{x^2 + 1}}$.

9. (3 marks) Find the equation of the tangent line to the graph of $f(x) = \tan^2 x$ at the point $\left(\dfrac{\pi}{4}, 1\right)$. Write your answer in slope-intercept form.

10. (2 marks) Prove $\dfrac{d}{dx}[\cot x] = -\csc^2 x$.