

Show all your work! You are allowed to use the one-half sheet of notes (one-sided) that you prepared for this exam. You are also allowed to use a calculator, but **only for numerical use, no graphs.**

1. If $f(1) = 3$ and $f'(1) = -2$, then estimate $f(1.3)$ using the tangent line of f .

2. If $F(x) = \sqrt{1 + \sin(x)}$, find functions $f(x)$, $g(x)$ and $h(x)$ so that $F = f \circ g \circ h$.

3. Solve for x (exact or as a numerical approximation, your choice):

(a) $\log_9(x) = \frac{3}{2}$

(b) $4^{3x-1} = 5$

(c) $3^{2 \log_3(x)} = 9$

4. Solve $\sin(x) = -0.4$ using the arcsine, for all x in $[0, 2\pi]$ (you may use numerical approximations).

5. Find the limit (algebraically), if it exists: $\lim_{x \rightarrow 2} \frac{x^2 - 2x}{x^2 - 4}$

6. Using the **definition** of the derivative, find $f'(4)$ if $f(x) = \sqrt{x}$

7. Sketch a function p that satisfies all of the following:

(a) $p(-1) = 1$, and $\lim_{x \rightarrow -1} p(x) = 0$

(b) $p(0) = 1$ and $p'(0) = -1$ and $p''(0) > 0$.

(c) p is continuous at $x = 1$, but is not differentiable there.

8. Sketch a right triangle with angle θ and length of the side adjacent is x , and the hypotenuse length is 1. Determine the simplest expression you can for each of the following in terms of x :

(a) $\csc(\theta) =$

(b) $\tan(\arccos(x)) =$

9. Find **exact** values of each of the following:

(a) $\arcsin(\sin(5\pi/6))$

(b) $\cot(2\pi/3)$

(c) $\cos(\arcsin(1/2))$

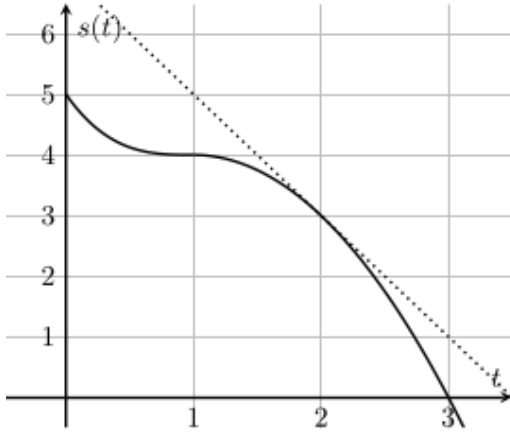
10. Given $f(t) = -3\cos(5t) + 6$,

(a) What is the amplitude of f ?

(b) What is the midline of f ?

(c) What is the period of f ?

11. The curve below shows a function $s(t)$, in feet, that measures displacement of an object at time t , measured in seconds. The dotted line shown is a tangent line to the curve.



- (a) Find the average rate of change of s over the interval $t = 0$ to $t = 3$. Include units.
- (b) Find the instantaneous velocity at $t = 2$. Include units.
- (c) Find the equation of the tangent line (the dotted line in the graph).
12. A cup of warm water at 100 degrees C is placed in a room that has constant temperature 5 degrees C. Five minutes later, the temperature of the water is 75 degrees C. Use the model for heating and cooling to find a function for the temperature of the water at time t .