

Instructions: This quiz is closed book, closed note, and an individual effort. Electronic devices other than approved calculators are not allowed on your person (e.g., no cell phones or calculators with CAS). Answer each question. **Show all work to receive full credit.** Unless the question specifies, you may provide either an exact answer or round to two decimal places.

(7 pts) 1) Find **all** the maxima and minima of the differentiable function $f(x)$, given its derivative:

$$f'(x) = x^2(x+5)(x+4)(x-3)$$

Clearly justify, in complete sentences, why the relevant points are maxima or minima. You may use either the first or second derivative test. For your convenience, I have included the table for the first derivative test below:

	$(x+5)$	$(x+4)$	x^2	$(x-3)$	$f'(x)$
$x < -5$	-	-	+	-	-
$-5 < x < -4$	+	-	+	-	+
$-4 < x < 0$	+	+	+	-	-
$0 < x < 3$	+	+	+	-	-
$x > 3$	+	+	+	+	+

Answer: Observe that $f'(x)$ changes sign from negative to positive at $x = -5$ and $x = 3$. So by the First Derivative Test, $f(x)$ has local minima at $x = -5$ and $x = 3$. Similarly, $f'(x)$ changes sign from positive to negative at $x = -4$. So by the First Derivative Test, $f(x)$ has a local maximum at $x = -4$.

Note: $f'(x)$ does not change sign at $x = 0$. So $x = 0$ is neither a local maximum or minimum. You did not have to specify this on the quiz (nor will you on the exam), but you will lose points if you claim that $x = 0$ is a maximum or a minimum.

(3 pts) 2) Find **all** points of inflection for the following function. Justify in **complete sentences** why each point you found is a point of inflection.

$$f(x) = x^3 - 6x^2 + 12x - 5$$

Answer: A point of inflection is an input point x where the second derivative changes from positive to negative, or from negative to positive. We note that:

$$f''(x) = 6x - 12$$

So $f''(x) = 0$ at $x = 2$. When $x < 2$, $f''(x) < 0$. When $x > 2$, $f''(x) > 0$. So $x = 2$ is a point of inflection for $f(x)$.