

No calculators will be allowed and no partial credit will be given.

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1. Find all the critical points of  $f(x) = 2x^2 + 3x + 8$ , if any. Express your answer(s) in simplified form.
2. Find all the critical points of  $f(x) = \frac{1}{3}x^3 - \frac{5}{2}x^2 - 14x + \sin(\ln(2))$ , if any. Express your answer(s) in simplified form.
3. Find all the positive critical points of  $f(x) = 10x^2 + \frac{29}{x}$ , if any. Express your answer(s) in simplified form.
4. Find all the critical points of  $f(x) = (x - 5)^2(3x + 1)$ , if any. Express your answer(s) in simplified form.
5. Find all the critical points of  $f(x) = \frac{x - 2}{x^2 + 12}$ , if any. Express your answer(s) in simplified form.
6. Find all critical points of  $f(x) = (2x - 5)e^{6x}$ , if any. Express your answer(s) in simplified form.
7. Suppose the twice differentiable function has derivatives with signs as in the chart below. State the interval(s) on which  $f$  is increasing.

	$x < 2$	$2 < x < 4$	$4 < x < 8$	$8 < x$
$f'(x)$	-	+	+	-
$f''(x)$	+	+	-	-

8. Suppose the twice differentiable function has derivatives with signs as in the chart below. State the interval(s) on which  $f$  is concave up.

	$x < 2$	$2 < x < 4$	$4 < x < 8$	$8 < x$
$f'(x)$	+	+	+	-
$f''(x)$	+	-	-	-

1.  $-\frac{3}{4}$
2.  $7, -2$
3.  $\left(\frac{29}{20}\right)^{\frac{1}{3}}$
4.  $5, 13/9$
5.  $-2, 6$
6.  $\frac{7}{3}$
7.  $(2, 8)$
8.  $(-\infty, 2)$