Show enough work to make it clear how you got your answer.
Do NOT use any methods except those discussed so far in this course.
Since you have no calculator for the quiz, your final answers might contain unevaluated expressions like $\frac{\ln 7}{6\ln 2}$.

1. Here is the graph of a <u>derivative</u>, $f'(x)$, where f has domain $(-2, 2)$.
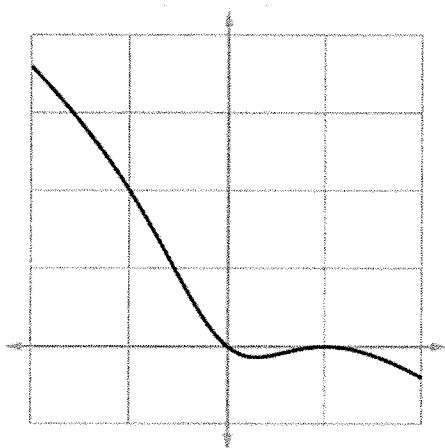
$f' > 0$ on $(-2, 0)$: f is increasing

$f' < 0$ on $(0, 1)$: f is decreasing

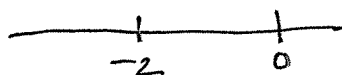$f' < 0$ on $(1, 2)$: f is decreasing

f has a local maximum at 0

On what open intervals is f increasing or decreasing?
Where do local maxima and minima of f occur (if any)?

2. For $f(x) = 3x^5 + 10x^4$: find the open intervals where f is concave up or down, and locate the inflection points (if any).

$f'(x) = 15x^4 + 40x^3$

$\quad = 5x^3(3x+8)$

$f''(x) = 60x^3 + 120x^2$

$\quad = 60x^2(x+2)$

$f''(x) = 0$ for $x = 0, x = -2$

$x < -2$: $f''(x) < 0$ f is concave down

$-2 < x < 0$: $f''(x) > 0$ ⎫
$0 < x$: $f''(x) > 0$ ⎭ f is concave up

f has an inflection point at $x = -2$.

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Since you have no calculator for the quiz, your final answers might
contain unevaluated expressions like $\frac{\ln 7}{6 \ln 2}$.

1. Here is the graph of a <u>second derivative</u>, $f''(x)$, where f has domain $(-2, 3)$.
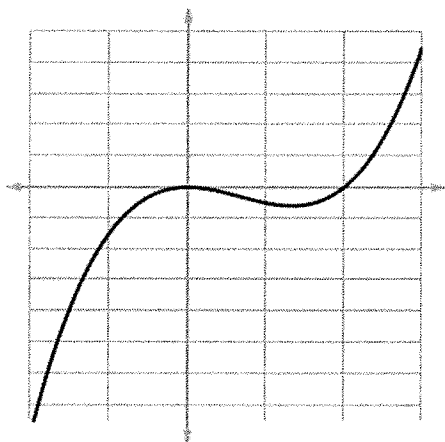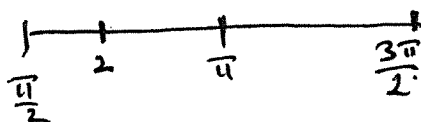
$f'' < 0$ when $-2 < x < 0$ $\left.\right\}$ f is concave down
$f'' < 0$ when $0 < x < 2$ $\left.\right\}$

$f'' > 0$ when $2 < x < 3$: f is conc. up.

f has an inflection point at $x = 2$.

On what open intervals is f concave up or concave down?
Where does f have inflection points (if any)?

2. Suppose $f(x)$ has domain $[\frac{\pi}{2}, \frac{3\pi}{2}]$ and $f'(x) = (x - 2)^2 \sin x$.

On what open intervals is f increasing and decreasing and where are the local maxima and local minima if f (if any)?

in $[\frac{\pi}{2}, \frac{3\pi}{2}]$: $\qquad$ $f'(x) = (x-2)^2 \sin x = 0$ if $x = 2$ or $x = \pi$

$(x-2)^2 \geqslant 0$ always

$\sin x > 0$ for $\frac{\pi}{2} < x < \pi$

$\sin x < 0$ for $\pi < x < \frac{3\pi}{2}$

so $f'(x) > 0$ for $\frac{\pi}{2} < x < \pi$: f is increasing
$f'(x) < 0$ for $\pi < x < \frac{3\pi}{2}$: f is decreasing
f has a local max at π.
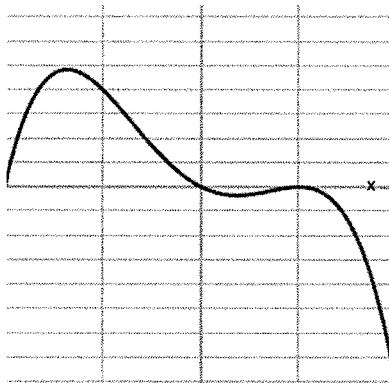
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*Since you have no calculator for the quiz, your final answers might
contain unevaluated expressions like $\frac{\ln 7}{6\ln 2}$.*

1. Here is the graph of a <u>second derivative</u>, $f''(x)$, where f has domain $(-2, 2)$.

$f'' > 0$ on $(-2, 0)$: f conc. up

$f'' < 0$ on $(0, 1)$: f conc. down

$f'' < 0$ on $(1, 2)$: f conc. down

f has an inflection point
at $x = 0$.

On what open intervals is f concave up or concave down? Where are the inflection
points of f (if any)?

2. Suppose $f'(x) = (x-1)(x+2)e^{-x}$.

What are the intervals on which f is increasing or decreasing, and where are the local
maxima or minima of f (if any)?

$f'(x) = 0$ when $x = -2$ $x = 1$


$x > 1$: $f' > 0$: f increasing

on $(-2, 1)$: $f' < 0$: f decreasing

on $(-\infty, -2)$: $f' > 0$: f' increasing

f has a local max at $x = -2$
f has a local min at $x = 1$

Show enough work to make it clear how you got your answer.
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1. Here is the graph of a <u>second derivative</u>, $f''(x)$, where f has domain $(-3, 3)$.
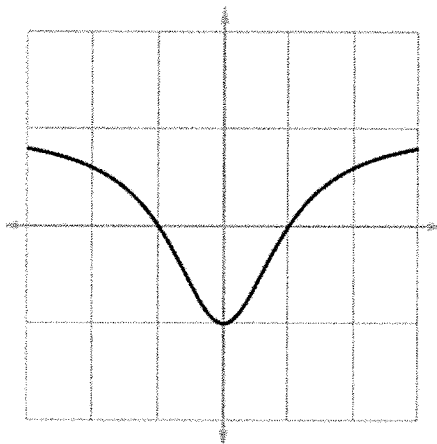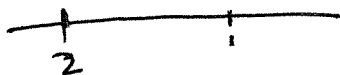
$f'' > 0$ on $(-3, -1)$: f conc. up
$f'' < 0$ on $(-1, 1)$: f conc. down
$f'' > 0$ on $(1, 3)$: f conc. up.

f has inflection points at
$x = -1$ and $x = 1$

On what open intervals is f concave up or concave down?
Where does f have inflection points (if any)?

2. Suppose $f'(x) = (x-1)^2(x+2)e^{-x}$.

What are the open intervals on which f is increasing or decreasing and where are the
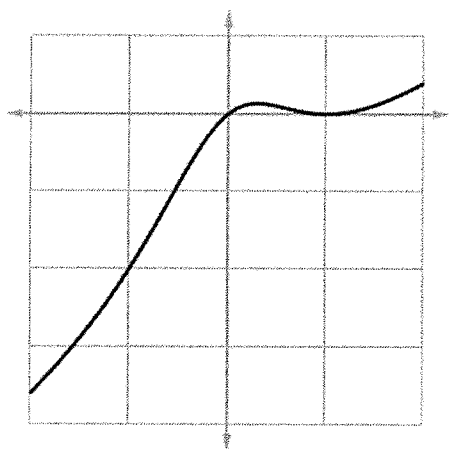local maxima or minima located (if any)?

$f'(x) = 0$ for $x = -2$, $x = 1$

$f' > 0$ on $(1, \infty)$: f is increasing
$f' > 0$ on $(-2, 1)$: f is increasing
$f' < 0$ on $(-\infty, -2)$: f is decreasing

f has a local minimum at $x = -2$

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contain unevaluated expressions like $\frac{\ln 7}{6 \ln 2}$.*

1. Here is the graph of a <u>second derivative</u>, $f''(x)$, where f has domain $(-2, 2)$.
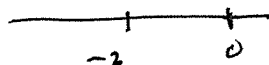

on $(-2, 0)$: $f'' < 0$ f conc. down

on $(0, 1)$: $f'' > 0$ f conc. up

on $(1, 2)$: $f'' > 0$ f conc. up.

f has an inflection point
at $x = 0$.

Where do local maxima and minima of f occur (if any)?
Where does f have inflection points (if any)?

2. If $f'(x) = 3x^4 + 8x^3$, then locate the open intervals on which f is concave up or
concave down, and locate the inflection points of f (if any).

$f''(x) = 12x^3 + 24x^2 = 12x^2(x+2) = 0$ when $x = -2$ or $x = 0$

$f'' < 0$ on $(-\infty, -2)$ f concave down

$f'' > 0$ on $(-2, 0)$ f concave up

$f'' > 0$ on $(0, \infty)$ f concave up

f has an inflection point
at $x = -2$