AB Calculus ’19-20
Dx Apps Quiz
No Calculator

Name Solution Key

1. On which of the following interval(s) is the function $y = -\frac{t^3}{3} + 3t^2 - 5t$ both increasing and concave down?

$y' +$ $y'' -$

$\frac{dy}{dx} = -t^2 + 6t - 5$ $\frac{d^2y}{dx^2} = -2t$

a) $(-\infty, 1)$ b) $(1,5)$ c) $(3,\infty)$ d) $(3,5)$ e) $(5,\infty)$

$\frac{dy}{dx}$ − 0 + 0 −
x 1 5

y'' + 0 −
3

2. Given the functions $f(x)$ and $g(x)$ that are both continuous and differentiable, and that they have values given on the table below.

x	$f'(x)$	$f''(x)$	$g'(x)$	$g''(x)$
2	0	2	-8	0
4	8	0	0	3
8	0	-12	0	4

Then at $x = 8$, $g(x)$ has a:

$g' = 0$ $g'' +$

a) Relative Maximum
b) Relative Minimum
c) Point of Inflection
d) Zero
e) None of these

3. Suppose $f'(x)=\dfrac{(x+1)^2(x-4)^5}{(x^3+8)}$. Which of the following statements must be **true**?

f' + DNE − 0 − 0 +

−2 −1 4

I. $f(x)$ has a relative maximum at $x=-1$

II. $f(x)$ is increasing on $x\in(-\infty,\,-4)$

III. $f(x)$ has a relative minimum at $x=4$

a) I only b) II only c) III only d) I and II e) II and III only

ab) I and III only ac) I, II, and III ad) None of these

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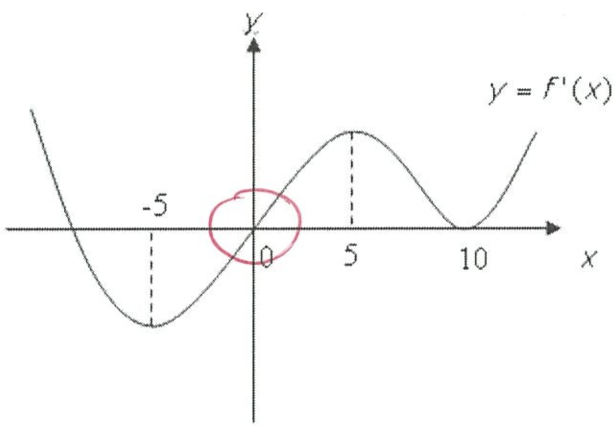
4. Below is the graph of $f'(x)$. For what value(s) of x does $f(x)$ have a minimum?

$f'=0$

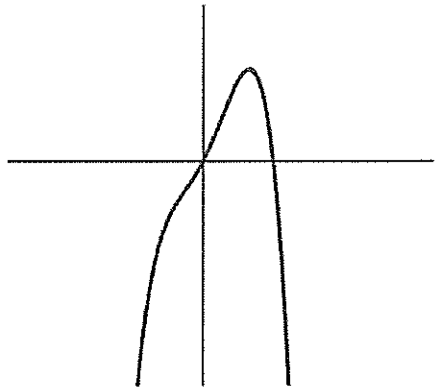
AND − to +



a) 0 only b) 0 and 10 c) -5 and 5

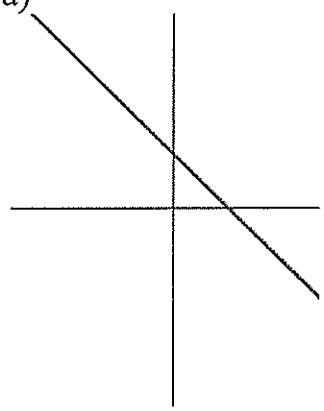
d) -5 and 10 e) None of these

5. The function $h(x)$ is graphed below.



Which of these functions represents $h'(x)$?

a)



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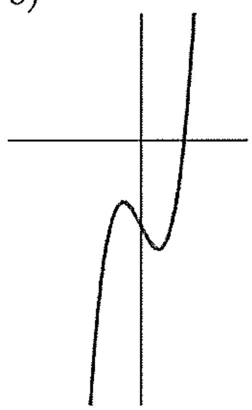
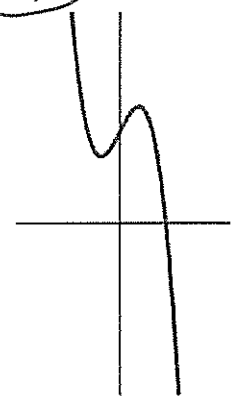
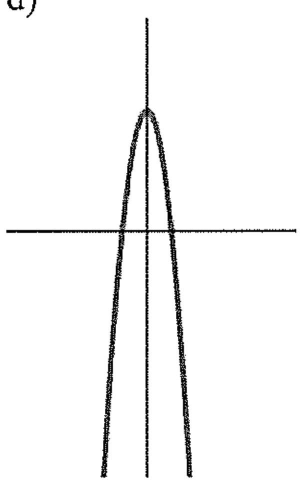


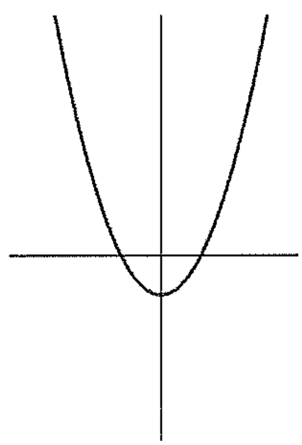
c)



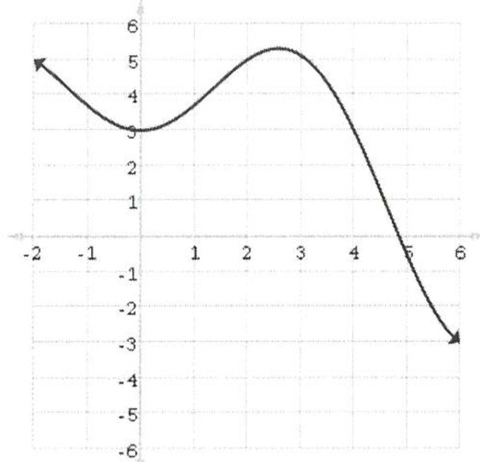
d)



e)



6. The graph below is of $g''(x)$, the **second** derivative of $g(x)$. Which of these statements is true about $g(x)$?



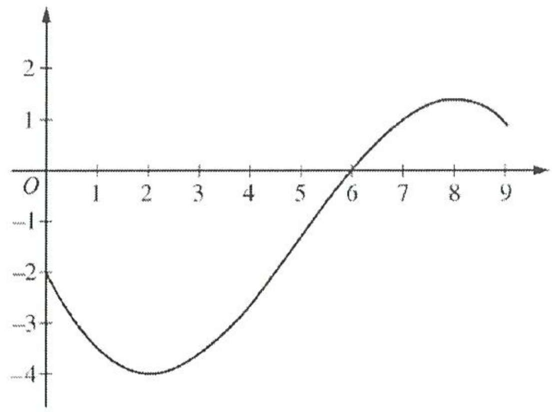
I. $g(x)$ is concave up on the interval $(3,4)$ g'' is +

~~II.~~ $g(x)$ has a point of inflection at x=0 NO

III. The derivative of $g(x)$ is increasing on $(3,4)$

a) I only b) II only c) III only d) I and II only

e) II and III only f) I and III only g) I, II, and III



Graph of f

7. The graph of differentiable equation f is shown above. If $h(x)=\int_0^x f(t)\,dt$, which of the following is true?

$h' = f$

$h'' = f'$

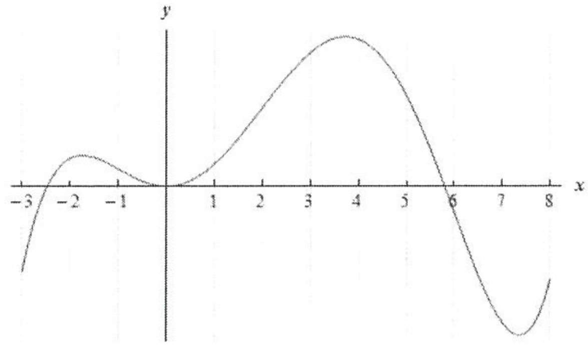
a) $h(6)<h'(6)<h''(6)$
b) $h(6)<h''(6)<h'(6)$
c) $h'(6)<h(6)<h''(6)$
d) $h''(6)<h(6)<h'(6)$
e) $h''(6)<h'(6)<h(6)$

$f(6) = 0$

$f'(6)$ POSITIVE

$\int_0^6$ IS NEGATIVE

8. Below is the graph of $f'(x)$, the derivative of $f(x)$. Which of the following statements is true about $f(x)$ on the interval $-3 < x < 8$?



a) $f(x)$ has two relative minima, one relative maximum, and three points of inflection.
b) $f(x)$ has two relative minima, one relative maximum, and two points of inflection.
c) $f(x)$ has one relative minimum, one relative maximum, and three points of inflection.
d) $f(x)$ has one relative minimum, two relative maxima, and four points of inflection.
e) $f(x)$ has one relative minimum, one relative maximum, and four points of inflection.

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9. An object moves with velocity $v(t) = \sec^2(2t)$. It is known that the particle's position at time 0 is 2. What is the particle's position function?

a) $s(t) = \tan(2t) + 2$

b) $s(t) = \frac{1}{2}\tan(2t) + 2$

c) $s(t) = \sec^2(2t)\tan^2(2t) + 2$

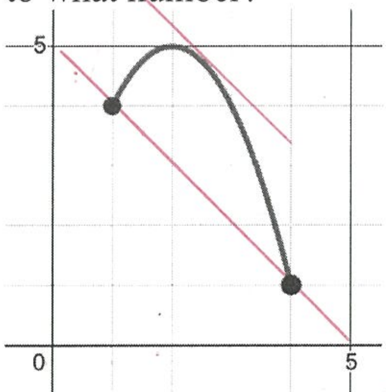
d) $s(t) = \ln|\sec(2t)| + 2$

e) $s(t) = \frac{1}{2}\ln|\sec(2t)| + 2$

$x(t) = \int \sec^2 2t \, dt$

$= \frac{1}{2} \tan 2t + C$

10. The function $f(x)$ is shown below on the closed interval $x \in [1,4]$. The c value guaranteed by the Mean Value Theorem for $f(x)$ on this interval is closest to what number?



$$\frac{f(4)-f(1)}{4-1} = \frac{1-4}{3} = -1$$

a) 1 b) 2 c) 3 d) 4 e) 5

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11. Find the maximum value of $y = x^2 - 4x$ on $0 \le x \le 3$.

a) -4
b) -3
c) 0
d) 2
e) No maximum value exists

$\frac{dy}{dx} = 2x - 4 = 0$

$x = 2$

cv	y
0	0
2	-4
3	-3

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12. Find the average rate of change of $w(x) = \cos(x)$ on $x \in \left[\frac{\pi}{3}, \frac{\pi}{2}\right]$.

a) $\frac{-3}{\pi}$ b) $\frac{3}{\pi}$ c) $3\pi\sqrt{3}$ d) $\frac{6-3\sqrt{3}}{\pi}$ e) $\frac{-\pi}{12}$

$$\frac{\cos \pi/2 - \cos \pi/3}{\pi/2 - \pi/3} = \frac{0 - 1/2}{\pi/6} = -\frac{3}{\pi}$$

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Score___________

Directions: Show all work.

x	$-3 \le x < -1$	$x = -1$	$-1 < x < 1$	$x = 1$	$1 < x \le 3$
$f'(x)$	Negative	0	Negative	0	Positive
$f''(x)$	Negative	dne	Positive	3	Positive

1. A function f is continuous on the interval $x \in [-3, 3]$ such that $f(-3) = 6$ and $f(3) = 1$. The functions f' and f'' have the properties given above.

a) Find all the values of x for which f has a maximum or a minimum on $x \in [-3, 3]$. Justify your answer.

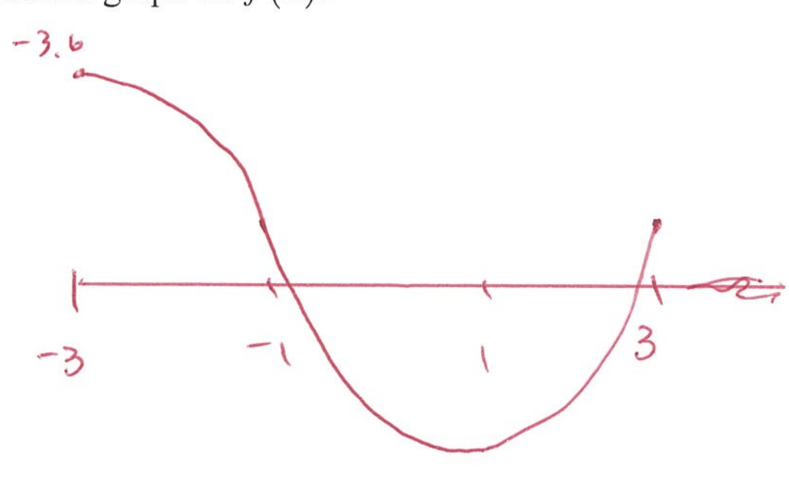
MIN @ X = 1 BECAUSE OF SIGN CHANGE ON f' FROM #1 NEG TO POS

MAX @ X = −3 BECAUSE LEFT END FOLLOWED BY NEG
" @ X = 3 " RIGHT END PRECEEDED BY POSITIVE

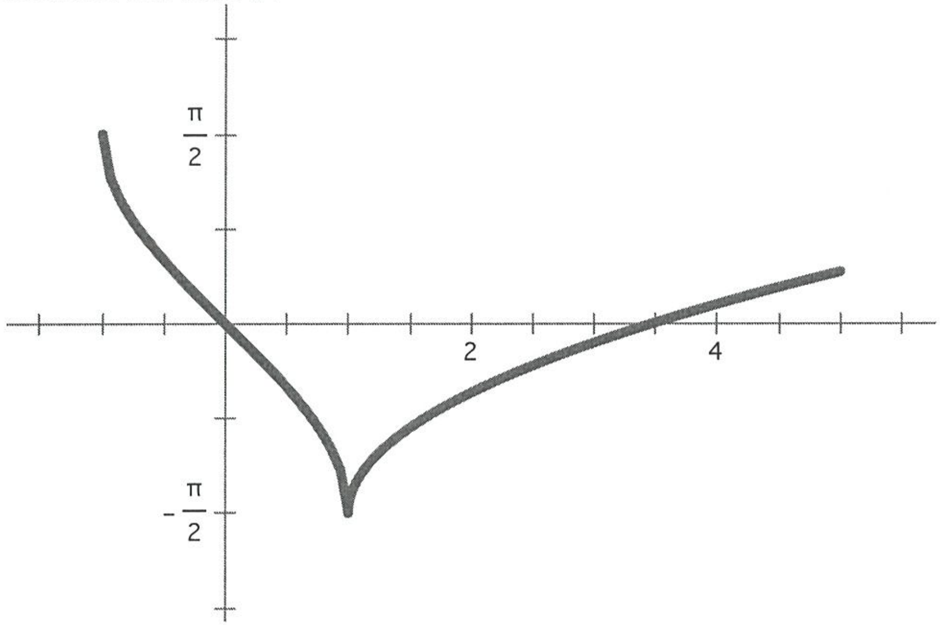
b) Find all the values of x for which f has a point of inflection on $x \in [-3, 3]$. Justify your answer.

X = −1 BECAUSE f'' SIGN CHANGE

c) Sketch a graph of $f(x)$.



2. Let $g(x)$ be a continuous function on $x \in [-1, 5]$ where the graph of $g'(x)$ is the function shown below.



a) Identify the x-value(s) of the relative maximums of $y = g(x)$? Justify your answer.

MAX AT $X=0$ AND $X=5$

$X=0 \Rightarrow f'$ SIGN CHANGE FROM + TO −

$X=5 \Rightarrow$ RIGHT END PRECEED BY +

b) Identify the x-value(s) of the relative minimums of $y = g(x)$? Justify your answer.

$X = 3.5$ BECAUSE f' SIGN CHANGE FROM − TO +

$X = -1$ BECAUSE LEFT ~~RIGHT~~ END FOLLOWED BY +

c) Where are the points of inflection on $y = g(x)$? Justify your answer.

$X = 1$ BECAUSE f' SWITCHES FROM DECREASING TO INCREASING