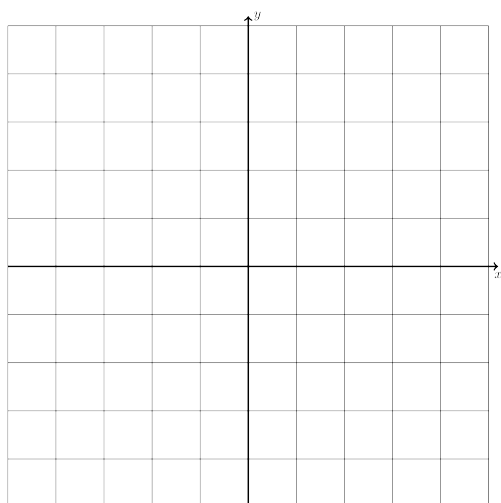---

1. (**1 point**) `setMidterm1/Problem1.pg`
Plot the points $(4, -3)$ and $(-4, 3)$ on a set of axes like the one below, and draw the straight line through the two points. Upload your answer as a pdf. Remember that you need to click on the upload button to actually save the pdf.

Find the equation of the straight line through the two points.

$y = $ _____

2. (**1 point**) `setMidterm1/Problem2.pg`
Evaluate the following limit algebraically, your answer may be a number, Inf, -Inf, or DNE. Upload your answer as a pdf.

$$\lim_{x \to 3} \frac{x^2 - 5x + 6}{x - 3}$$

_____

---

3. (**1 point**) `setMidterm1/Problem3.pg`
Evaluate the following limit algebraically, your answer may be a number, Inf, -Inf, or DNE. Upload your answer as a pdf.

$$\lim_{x \to 4} \frac{x - 4}{\sqrt{x} - 2}$$

_____

4. (1 point) `setMidterm1/Problem4.pg`

Use the limit definition of the derivative to differentiate $f(x) = 3x^2 + 3x$. Upload your answer as a pdf.

_____

5. (1 point) `setMidterm1/Problem5.pg`

Use the limit definition of the derivative to differentiate $f(x) = \dfrac{1}{x+1}$. Upload your answer as a pdf.

_____

6. (1 point) `setMidterm1/Problem6.pg`

The graph of $f(x)$ is given in the top picture. Sketch the graph of $f'(x)$ in the bottom picture. Upload your answer as a pdf - you can just sketch the axes freehand on blank paper if you don't have a printer.
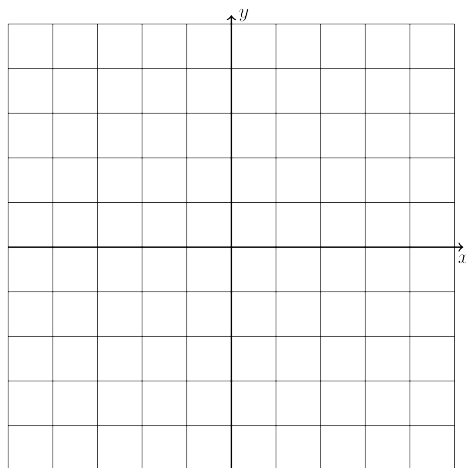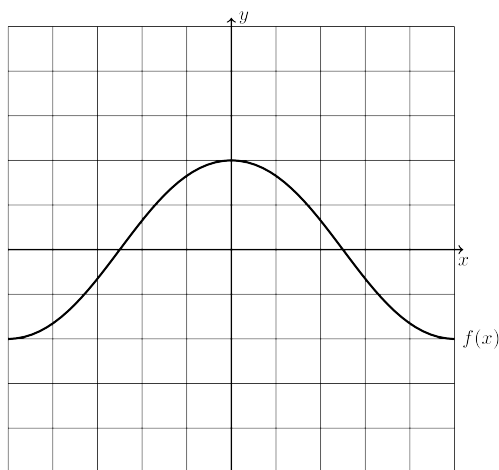
7. (1 point) `setMidterm1/Problem7.pg`

Find the horizontal asymptotes of $f(x) = \dfrac{\sqrt{4x^2 - 4}}{x+4}$.

If there's more than one, enter a comma separated list.

$y =$ _____

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8. (1 point) `setMidterm1/Problem8.pg`

Find the first and second derivatives of $f(x) = (x+6)e^x$.

$f'(x) =$ _____

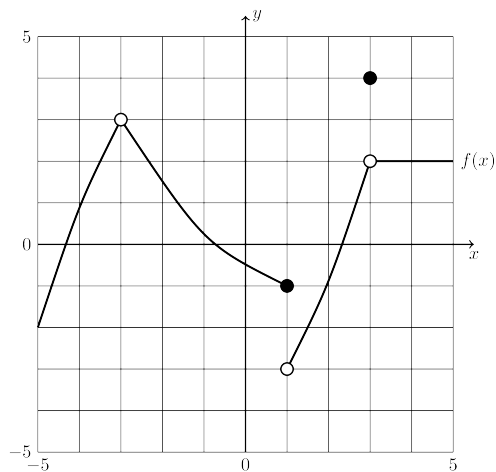$f''(x) =$ _____

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9. (1 point) `setMidterm1/Problem9.pg`

Find the first and second derivatives of $f(x) = 3/\sqrt{x}$.

$f'(x) =$ _____

$f''(x) =$ _____

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10. (1 point) `setMidterm1/Problem10.pg`

The graph of $y = f(x)$ is shown below. Evaluate each limit, or write DNE if the limit does not exist. No justifications are necessary.

(a) $\lim\limits_{x \to -2} f(x)$ _____

(b) $\lim\limits_{x \to 1-} f(x)$ _____

(c) $\lim\limits_{x \to 1+} f(x)$ _____

3

(d) $\lim_{x \to 1} f(x)$ _____

(e) $\lim_{x \to 3+} f(x)$ _____

(f) $\lim_{x \to 3} f(x)$ _____

Midterm 1 Solutions

$$\text{slope} = \frac{-3-3}{4-(-4)} = -\frac{6}{8} = -\frac{3}{4}$$

Q1

(-4,3)

(4,-3)
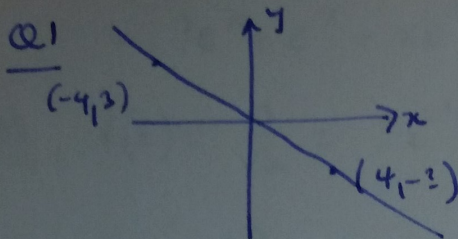
line $\quad y + 3 = -\frac{3}{4}(x - 4)$

Q2 $\lim\limits_{x \to 3} \dfrac{x^2 - 5x + 6}{x - 3} = \lim\limits_{x \to 3} \dfrac{(x-3)(x-2)}{(x-3)} = \lim\limits_{x \to 3} x - 2 = 1$

Q3 $\lim\limits_{x \to 4} \dfrac{x-4}{\sqrt{x}-2} = \lim\limits_{x \to 4} \dfrac{(\sqrt{x}-2)(\sqrt{x}+2)}{\sqrt{x}-2} = \lim\limits_{x \to 4} \sqrt{x}+2 = 4$

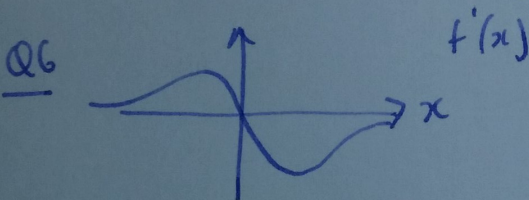**Q4** $f(x) = 3x^2 + 3x \qquad f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$f'(x) = \lim\limits_{h \to 0} \dfrac{3(x+h)^2 + 3(x+h) - (3x^2 + 3x)}{h} = \lim\limits_{h \to 0} \dfrac{3x^2 + 6xh + 3h^2 + 3x + 3h - 3x^2 - 3x - 3x}{h}$

$= \lim\limits_{h \to 0} 6x + 3h + 3 = 6x + 3$

Q5 $f(x) = \dfrac{1}{x+1} \qquad f'(x) = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$

$f'(x) = \lim\limits_{h \to 0} \dfrac{\frac{1}{x+h+1} - \frac{1}{x+1}}{h} = \lim\limits_{h \to 0} \dfrac{1}{h} \dfrac{x+1 - (x+h+1)}{(x+h+1)(x+1)} = \lim\limits_{h \to 0} \dfrac{-h}{h(x+h+1)(x+1)}$

$= \lim\limits_{h \to 0} \dfrac{-1}{(x+h+1)(x+1)} = \dfrac{-1}{(x+1)^2}$

Q6

$f'(x)$

Q7 $\lim\limits_{x \to \infty} \dfrac{\sqrt{4x^2 - 4}}{x + 4} = \lim\limits_{x \to +\infty} \dfrac{\sqrt{4 - 4/x^2}}{1 + 4/x} = 2$

$\lim\limits_{x \to -\infty} \dfrac{\sqrt{4x^2 - 4}}{x + 4} = \lim\limits_{x \to +\infty} \dfrac{\sqrt{4(-x)^2 - 4}}{-x + 4} = \lim\limits_{x \to +\infty} \dfrac{\sqrt{4 - 4/x^2}}{-1 + 4/x} = -2$

Q8 $f(x) = (x+6)e^x \qquad f'(x) = (x+6)' e^x + (x+6)(e^x)'$

$\qquad = 1e^x + (x+6)e^x = 7e^x + xe^x$

$f''(x) = 7e^x + (xe^x)' = 7e^x + (x)'e^x + (x)(e^x)'$

$= 7e^x + e^x + xe^x = 8e^x + e^x.$

29 $f(x) = \frac{3}{\sqrt{x}} = 3x^{-1/2}$ $f'(x) = -\frac{3}{2}x^{-3/2}$ $f''(x) = \frac{9}{4}x^{-5/2}$

210 a) 3 b) −1 c) −3 d) DNE e) 2 f) 2