

1. (4 pts.) Find the derivatives of the following functions:

(a)  $f(x) = x^3 + e^3$       $f'(x) = 3x^2 + 0 = \boxed{3x^2}$      ( $e^3$  is a constant)

(b)  $f(x) = \frac{3e^x}{2\pi + 3} + x = \frac{3}{2\pi + 3} e^x + x$       $f'(x) = \frac{3}{2\pi + 3} e^x + 1 = \boxed{\frac{3e^x}{2\pi + 3} + 1}$

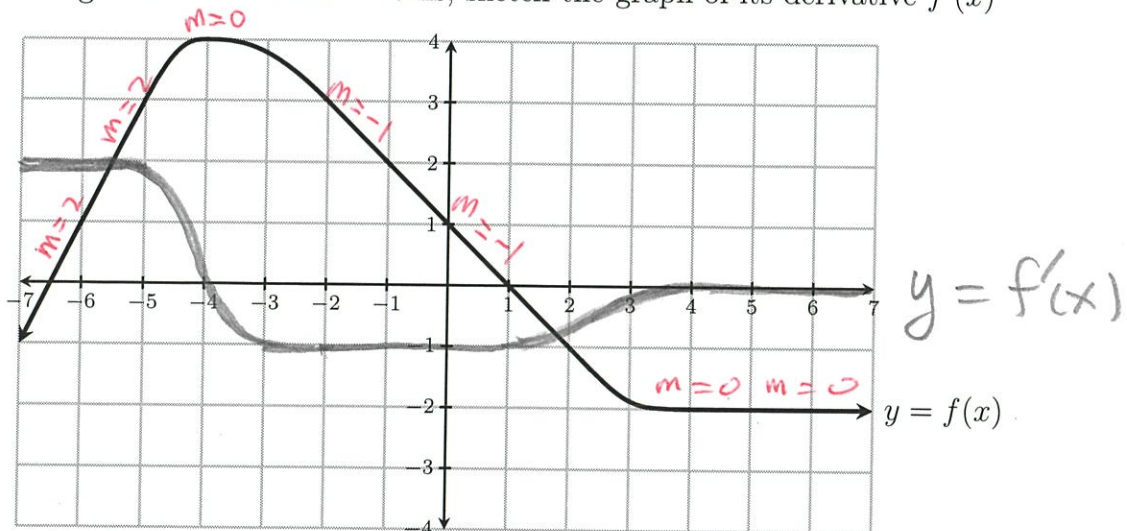
2. (8 pts.) Find all  $x$  for which the tangent to the graph of  $f(x) = x^3 + 3x^2 + 3x$  at  $(x, f(x))$  has slope  $m = 12$ .

Need to solve  
 $f'(x) = 12$   
 $3x^2 + 6x + 3 = 12$   
 $3(x^2 + 2x + 1) = 12$   
 $x^2 + 2x + 1 = 4$   
 $x^2 + 2x - 3 = 0$

$\rightarrow (x-1)(x+3) = 0$   
 $\downarrow \quad \downarrow$   
 $x=1 \quad x=-3$

Answer: Tangent has slope  $m = 12$  at  $x = 1$  and  $x = -3$

3. (8 pts.) The graph of a function  $f(x)$  is shown below. Using the same coordinate axis, sketch the graph of its derivative  $f'(x)$ .



1. (4 pts.) Find the derivatives of the following functions:

(a)  $f(x) = 5e^x + 2e^2$       $f'(x) = 5e^x + 0 = \boxed{5e^x}$

*2e<sup>2</sup> is a constant*

(b)  $f(x) = \frac{2e^x}{1+\sqrt{2}} = \frac{2}{1+\sqrt{2}} e^x$       $f'(x) = \frac{2}{1+\sqrt{2}} e^x = \boxed{\frac{2e^x}{1+\sqrt{2}}}$

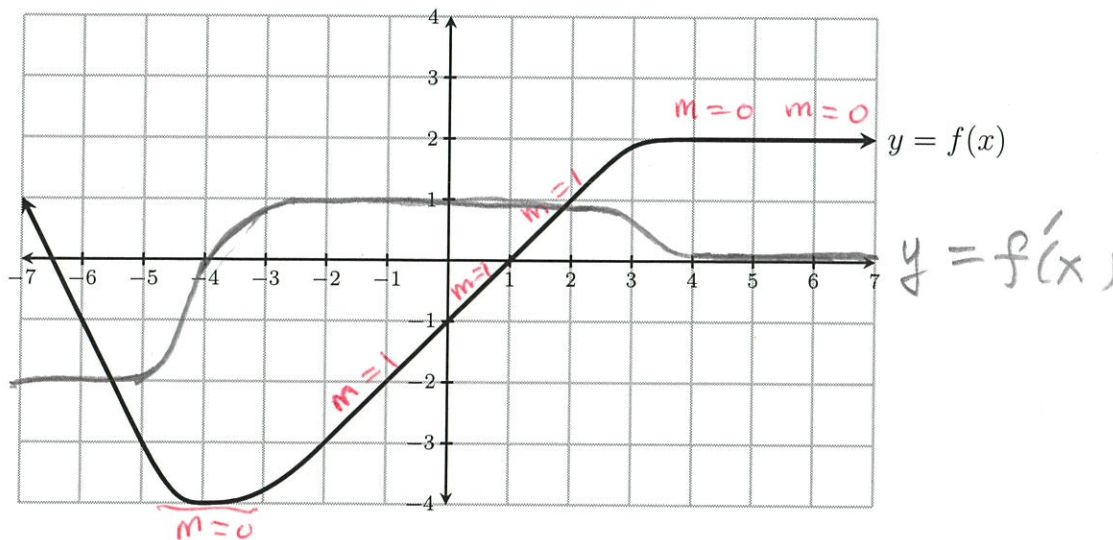
2. (8 pts.) Find all  $x$  for which the tangent to the graph of  $f(x) = x^3 + 3x^2 + 3$  at  $(x, f(x))$  has slope  $m = -3$

Need to solve  
 $f'(x) = -3$   
 $3x^2 + 6x = -3 - 3$   
 $3x^2 + 6x + 3 = 0$   
 $3(x^2 + 2x + 1) = 0$

$3(x+1)(x+1) = 0$   
 $\downarrow$   
 $x = -1$

Answer Tangent has slope  $m = -3$  at  $x = -1$

3. (8 pts.) The graph of a function  $f(x)$  is shown below. Using the same coordinate axis, sketch the graph of its derivative  $f'(x)$ .



1. (4 pts.) Find the derivatives of the following functions:

(a)  $f(x) = \pi e^x + e$

$$f'(x) = \pi e^x + 0 = \pi e^x$$

*e is a constant*

(b)  $f(x) = \frac{1+e}{x} = (1+e)x^{-1}$

$$f'(x) = (1+e)(-x^{-1-1}) = -(1+e)x^{-2} = \frac{-(1+e)}{x^2}$$

2. (8 pts.) Find all  $x$  for which the tangent to the graph of  $f(x) = 4x - e^x$  at  $(x, f(x))$  has slope 3.

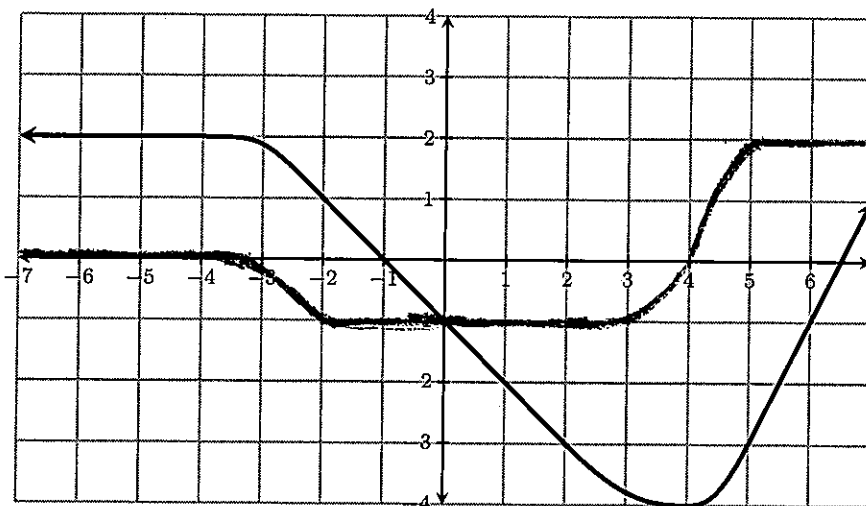
Need to solve  $f'(x) = 3$

$$4 - e^x = 3$$

$$1 = e^x$$

$$\ln(1) = \ln(e^x)$$

$$0 = x$$

AnswerTangent has slope 3 at  $x = 0$ 3. (8 pts.) The graph of a function  $f(x)$  is shown below.  
Using the same coordinate axis, sketch the graph of its derivative  $f'(x)$ .

$$y = f'(x)$$

$$y = f(x)$$

1. (4 pts.) Find the derivatives of the following functions:

(a)  $f(x) = \frac{e}{x} = ex^{-1}$   $f'(x) = e(-x^{-1-1}) = -ex^{-2} = \boxed{\frac{-e}{x^2}}$

(b)  $f(x) = \sqrt{e} - 3e^x$   $f'(x) = 0 - 3e^x = \boxed{-3e^x}$

$\sqrt{e}$  is a constant

2. (8 pts.) Find all  $x$  for which the tangent to the graph of  $f(x) = \frac{1}{x} + 6x$  at  $(x, f(x))$  has slope  $m = 2$ .

Need to solve

$$f'(x) = 2$$

$$-x^{-2} + 6 = 2$$

$$-\frac{1}{x^2} = -4$$

$$1 = 4x^2$$

$$x^2 = \frac{1}{4}$$

$$x = \pm \sqrt{\frac{1}{4}} = \pm \frac{1}{2}$$

Answer Tangent has slope 2 at  $x = \frac{1}{2}$  and also at  $x = -\frac{1}{2}$

3. (8 pts.) The graph of a function  $f(x)$  is shown below. Using the same coordinate axis, sketch the graph of its derivative  $f'(x)$ .

