Calculus 1 Workbook

Tangent and normal lines

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MATH

TANGENT LINES

■ 1. Find the equation of the tangent line to the graph of the equation at $(1/2,\pi)$.

$$f(x) = 4\arctan 2x$$

■ 2. Find the equation of the tangent line to the graph of the equation at $(-1,-9)$.

$$g(x) = x^3 - 2x^2 + x - 5$$

■ 3. Find the equation of the tangent line to the graph of the equation at $(0,-4)$.

$$h(x) = -4e^{-x} + 3x$$

■ 4. Find the equation of the tangent line to the graph of the equation at $(1,1)$.

$$f(x) = -6x^4 + 4x^3 - 3x^2 + 5x + 1$$

■ 5. At what point(s) is the tangent line of $f(x) = 2x(3-x)^2$ horizontal?

6. Find the constants a, b, and c such that the function $f(x) = ax^2 + bx + c$ intersects the point $(-2,5)$ and has a horizontal tangent line at $(0, -3)$.

VALUE THAT MAKES TWO TANGENT LINES PARALLEL

■ 1. Find the value of a such that the tangent lines to $f(x) = 2x^3 + 2$ at $x = a$ and $x = a + 1$ are parallel.

■ 2. Find the value of a such that the tangent lines to $g(x) = x^3 + x^2 + 7$ at $x = a$ and $x = a + 1$ are parallel.

■ 3. Find the value of a such that the tangent lines to $h(x) = \tan^{-1} x$ at $x = a$ and $x = a + 1$ are parallel.

■ 4. Find parallel tangent lines to $f(x) = 4x^3 - 6x + 7$ at $x = a$ and $x = a + 1$.

■ 5. Find the value of a such that the tangent lines to $g(x) = (x - 2)^3 + x^2 + 3$ at $x = a$ and $x = a + 1$ are parallel.

■ 6. Find the approximate value of a, rounded to the nearest hundredth, such that the tangent lines to $h(x) = e^x - 3x^2$ at $x = a$ and $x = a + 1$ are parallel.

VALUES THAT MAKE THE FUNCTION DIFFERENTIABLE

■ 1. What value of a and b will make the function differentiable?

$$f(x) = \begin{cases} x^2 & x \leq 3 \\ ax - b & x > 3 \end{cases}$$

■ 2. What value of a and b will make the function differentiable?

$$g(x) = \begin{cases} ax + b & x \leq -1 \\ bx^2 - 1 & x > -1 \end{cases}$$

■ 3. What value of a and b will make the function differentiable?

$$h(x) = \begin{cases} ax^3 & x \leq 2 \\ x^2 - b & x > 2 \end{cases}$$

■ 4. What value of a and b will make the function differentiable?

$$f(x) = \begin{cases} 3 - x & x \leq 1 \\ ax^2 - bx & x > 1 \end{cases}$$

■ 5. What value of a and b will make the function differentiable?

$$g(x) = \begin{cases} x^3 & x \leq 1 \\ a(x-2)^2 - b & x > 1 \end{cases}$$

6. What value of a and b will make the function differentiable?

$$h(x) = \begin{cases} ax^2 + b & x \leq 3 \\ bx + 4 & x > 3 \end{cases}$$

NORMAL LINES

■ 1. Find the equation of the normal line to the graph of $f(x) = 5x^4 + 3e^x$ at $(0,3)$.

■ 2. Find the equation of the normal line to the graph of $g(x) = \ln e^{4x} + 2x^3$ at $(2,24)$.

■ 3. Find the equation of the normal line to the graph of $h(x) = 5\cos x + 5\sin x$ at $(\pi/2,5)$.

■ 4. Find the equation of the normal line to the graph of $f(x) = 7x^3 + 2x^2 - 5x + 9$ at $(2,63)$.

■ 5. Find the equation of the normal line to the graph of $g(x) = 5\sqrt{x^2 - 14x + 49}$ at $(2,25)$.

■ 6. Find the equations of the tangent and normal lines of $g(x) = (2x^2 - 5x + 3)^2$ at $(0,9)$.

AVERAGE RATE OF CHANGE

■ 1. Find the average rate of change of the function over the interval $[4,9]$.

$$f(x) = \frac{5\sqrt{x} - 2}{3}$$

■ 2. Find the average rate of change of the function over the interval $[16,25]$.

$$g(x) = \frac{2x - 8}{\sqrt{x} - 2}$$

■ 3. Find the average rate of change of the function over the interval $[0,4]$.

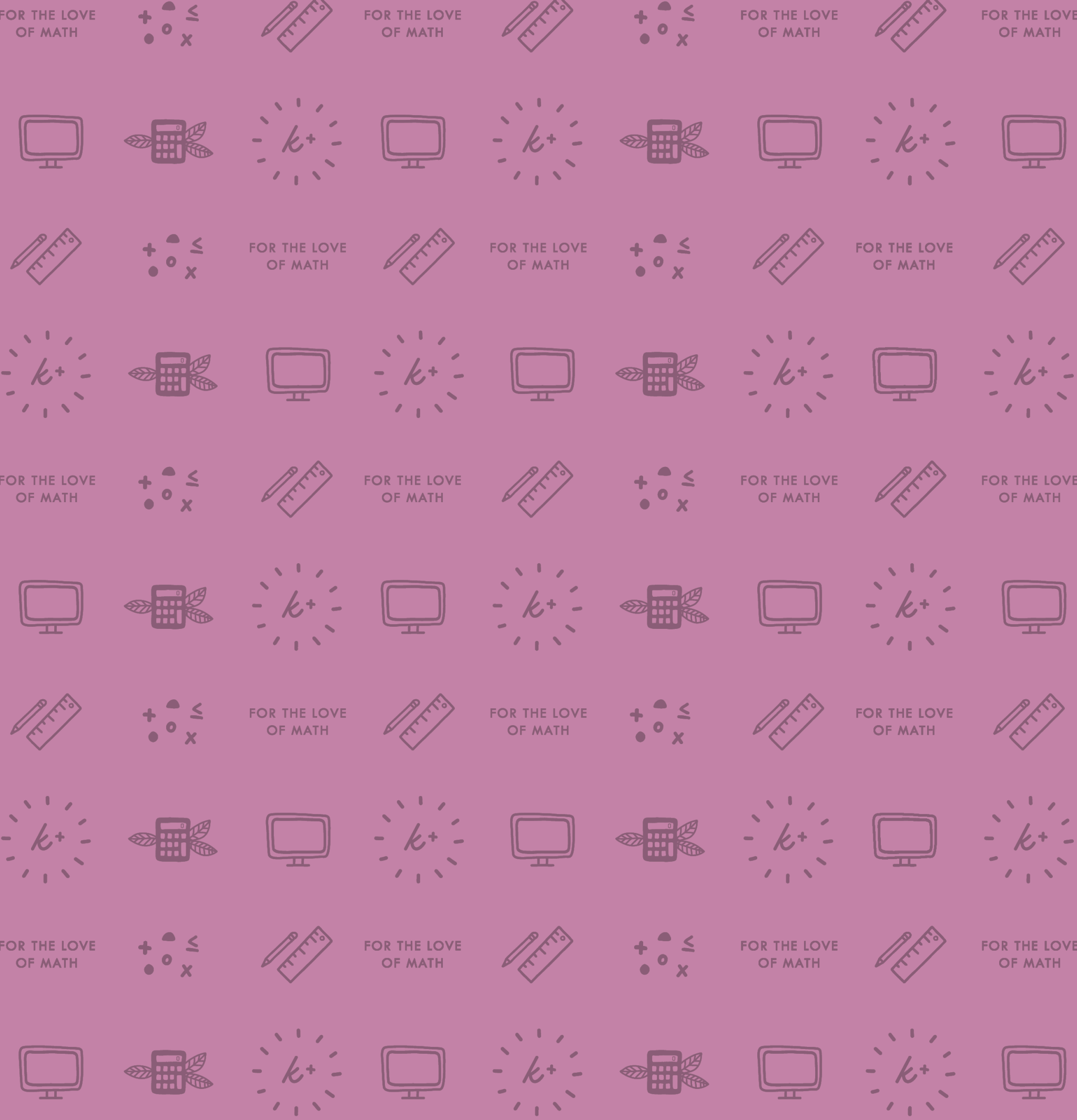
$$h(x) = \frac{x^3 - 8}{x^2 - 4x - 5}$$

■ 4. Find the average rate of change of the function over the interval $[-2, -3/2]$.

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

■ 5. On Thursday, the price of a gallon of gas was $\$3.24$. What was the price of a gallon of gas on Sunday, if the average rate of change of the price of a gallon of gas from Thursday to Sunday is $\$0.09$ per day?

■ 6. Find an expression in terms of a that models the average rate of change of the function $f(x) = 2x^2 + 5x - 4$ over the interval $[0,2a]$.



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