AP CALCULUS AB • EXERCISE SHEET

# 4.6 Local Linearity and Linearization

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

## Objective

Build the skills to answer exam questions on **local linearity and linearization**.

**You must be able to:**

- write the **linearization** 线性化 $L(x) = f(a) + f'(a)(x - a)$
- use it to approximate a value

## 1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ **Linearization**

Near $x = a$,

$$f(x) \approx L(x) = f(a) + f'(a)(x - a)$$

—the tangent line at $a$.

■ **Example**

$f(x) = \sqrt{x}$ at $a = 4$: $f(4) = 2$, $f'(4) = \frac{1}{4}$, so $L(x) = 2 + \frac{1}{4}(x - 4)$ and $\sqrt{4.1} \approx 2.025$.

## 2 Practice

**2.1** Write the linearization formula. [1]

**2.2** For $f(x) = \sqrt{x}$ at $a = 4$, state $f(4)$ and $f'(4)$. [2]

**2.3** State what $L(x)$ approximates. [1]

## 3 Exam-style questions

**3.1** The linearization of $f$ at $a$ is [1]

- **A** $f(a)$
- **B** $f(a) + f'(a)(x - a)$
- **C** $f'(a)(x - a)$
- **D** $f(x) \cdot a$

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**3.2** Linearization uses the _____ line. [1]

- **A** secant
- **B** tangent
- **C** normal
- **D** horizontal

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**3.3** $f(x) = x^2$, $a = 3$, so $f(3) = 9$, $f'(3) = 6$.

(a) Write $L(x)$. [1]

(b) Use it for $x = 3.1$. [1]

(c) State $L(3.1)$. [1]

## 4 Go further

- work through the **4.6 Approximating Values of a Function Using Local Linearity and Linearization** lesson on the **Learn** page;
- read the **Contextual Applications of Differentiation** section of the AP Calculus AB handout on the **Know** page.

## Solutions

**2.1** $L(x) = f(a) + f'(a)(x - a)$.

**2.2** $f(4) = 2$; $f'(4) = \frac{1}{4}$.

**2.3** the value of $f(x)$ for $x$ near $a$.

**3.1 B**.

**3.2 B**.

**3.3** (a) $L(x) = 9 + 6(x - 3)$. (b) $9 + 6(0.1)$. (c) 9.6.