

## Recognizing Derivatives as Limits

Each of the limits below represents  $f'(a)$  for some function  $f$  and some number  $a$ .

Find  $f(x)$  and  $a$  in each case.

$$1. \lim_{h \rightarrow 0} \frac{\sin(\pi + h) - \sin \pi}{h}$$

$$9. \lim_{h \rightarrow 0} \frac{\frac{9}{10+h} - \frac{9}{10}}{h}$$

$$2. \lim_{h \rightarrow 0} \frac{(4+h)^2 - 16}{h}$$

$$10. \lim_{h \rightarrow 0} \frac{5(3+h) - 15}{h}$$

$$3. \lim_{h \rightarrow 0} \frac{\cos(\pi + h) + 1}{h}$$

$$11. \lim_{h \rightarrow 0} \frac{2\sqrt{9+h} - 6}{h}$$

$$4. \lim_{h \rightarrow 0} \frac{(3+h)^2 - 9}{h}$$

$$12. \lim_{h \rightarrow 0} \frac{(1+h)^2 + (1+h) - 2}{h}$$

$$5. \lim_{h \rightarrow 0} \frac{(3+h)^3 - 27}{h}$$

$$13. \lim_{h \rightarrow 0} \frac{5\left(\frac{1}{2} + h\right)^4 - 5\left(\frac{1}{2}\right)^4}{h}$$

$$6. \lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h}$$

$$14. \lim_{h \rightarrow 0} \frac{\tan\left(\frac{\pi}{3} + h\right) - \sqrt{3}}{h}$$

$$7. \lim_{h \rightarrow 0} \frac{\sqrt{25+h} - 5}{h}$$

$$15. \lim_{h \rightarrow 0} \frac{2(10+h)^2 - 3(10+h) - 170}{h}$$

$$8. \lim_{h \rightarrow 0} \frac{\frac{1}{7+h} - \frac{1}{7}}{h}$$