

Test Average : 74%

Test Solutions on Website

Do Suggested Homework.

$$\textcircled{3} \quad f(x) = -x^3 + 9x^2 - 24x + 5$$
$$f'(x) = -3x^2 + 18x - 24$$

$$\text{Set } f'(x) = 0 : \quad -3x^2 + 18x - 24 = 0$$
$$-3(x^2 - 6x + 8) = 0$$
$$-3(x-2)(x-4) = 0$$
$$x = 2, 4$$

$f'(x)$	\ominus	2	\oplus	4	\ominus
$f(x)$	DEC		INC		DEC

$$x < 2 \text{ or } x > 4$$

$$\textcircled{7} \quad f = 12x^3 \quad \frac{dx}{x} = 0.08$$

$$\frac{df}{f} = \frac{36x^2 dx}{12x^3}$$

$$\boxed{\frac{df}{dx} = 36x^2}$$

$$= \frac{3 dx}{x}$$

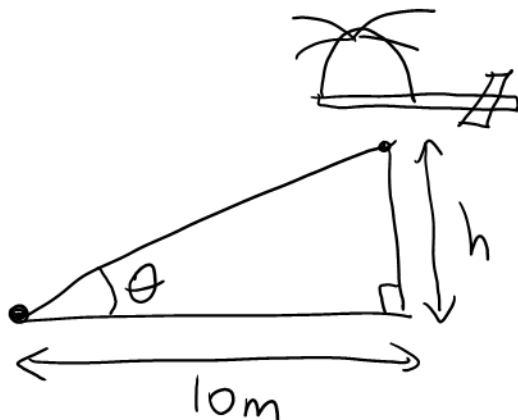
$$= 3 \left(\frac{dx}{x} \right)$$

$$= 3 (0.08)$$

$$= 0.24$$

27.8 Applications of Ch 27

Ex:

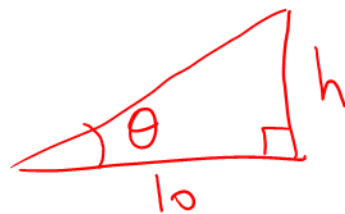


Helicopter is rising vertically at $3 \frac{\text{m}}{\text{s}}$ (constant). How fast is θ changing when $h = 12 \text{ m}$?

$$\frac{dh}{dt} = 3 \frac{\text{m}}{\text{s}}$$

$$\frac{d\theta}{dt} = ?$$

$$h = 12 \text{ m}$$



$$\tan \theta = \frac{h}{10}$$

$$\theta = \tan^{-1} \frac{h}{10}$$

Take $\frac{d}{dt}$:

$$\frac{d\theta}{dt} = \frac{d\theta}{dh} \frac{dh}{dt}$$

$$= \left[\frac{1}{1 + \left(\frac{h}{10}\right)^2} \left(\frac{1}{10}\right) \right] \frac{dh}{dt}$$

$$= \frac{1}{\left(1 + \left(\frac{12}{10}\right)^2\right)} \left(\frac{1}{10}\right) (3)$$

$$\approx 0.12 \frac{\text{rads}}{\text{s}}$$

Ex: Use a linear approximation to estimate $\sin\left(\frac{\pi}{180}\right)$

$$1) \quad f(x) \approx f(a) + f'(a)(x-a)$$

a : near $\frac{\pi}{180}$
and $\sin a$ is exact
 $\Rightarrow a = 0$

$$f(x) \approx f(0) + f'(0)(x-0)$$

$$f(x) = \sin x \quad f(0) = 0$$
$$f'(x) = \cos x \quad f'(0) = 1$$

$$\begin{aligned}\sin x &\approx 0 + 1(x-0) \\ &\approx x\end{aligned}$$

Valid near $x=0$

2) Sub $x = \frac{\pi}{180}$:

$$\sin \frac{\pi}{180} \approx \frac{\pi}{180}$$

25.1 Antiderivatives

Calculus Part 1: Derivatives
slope of tangent line, rate of change

Calculus Part 2: Integrals
areas, volumes

Ex: Find a function $f(x)$ so
that $f'(x) = 12x^5$.

$$\begin{aligned}f(x) &= ? x^6 \\ &= 2x^6\end{aligned}$$

$2x^6$ is an antiderivative of $12x^5$.

Other possibilities : $f(x) = 2x^6 + 1$
 $f(x) = 2x^6 + \pi$
 $f(x) = 2x^6 + C$
any constant

FACT

An antiderivative of x^n is $\frac{x^{n+1}}{n+1}$ ($n \neq -1$)

Ex: Find an antiderivative :

a) $f'(x) = x^3 + x^4$

$$f(x) = \frac{x^4}{4} + \frac{x^5}{5}$$

b) $f'(x) = \sqrt{x} + \frac{1}{x^4} + 3x^7$

$$f'(x) = x^{1/2} + x^{-4} + 3x^7$$

$$f(x) = \frac{2}{3}x^{3/2} - \frac{1}{3}x^{-3} + \frac{3x^8}{8}$$

c) $f'(x) = 1$

$$f'(x) = x^0$$

$$f(x) = x$$

$$d) \quad f'(x) = -3$$

$$f(x) = -3x$$

$f'(x)$	$f(x)$
7	$7x$
x^3	$\frac{x^4}{4}$
$9x^3$	$\frac{9x^4}{4}$
$x^{-1/3}$	$\frac{3}{2}x^{2/3}$
$3x^{-1/3}$	$3\left(\frac{3}{2}x^{2/3}\right) = \frac{9}{2}x^{2/3}$