Feb. 10, 2017

Warmup: Find inst. rate of change at $x=2$ for $f(x)=-2x^3+5x^2$.

$$m=\frac{f(a+h)-f(a)}{h}$$

$$=\frac{-2(a+h)^3+5(a+h)^2+2a^3-5a^2}{h}$$

$$
\begin{array}{ccccccc}
 & & & 1 & & & \\
 & & 1 & & 1 & & \\
 & 1 & & 2 & & 1 & \leftarrow (a+h)^2 \\
1 & & 3 & & 3 & & 1
\end{array}
$$

$$
\frac{a^3+3a^2h+3ah^2+h^3}{}
$$

$$
= \frac{-2(a^3+3a^2h+3ah^2+h^3)+5(a^2}{h}
$$

$$
= \frac{-2a^3-6a^2h-6ah^2-2h^3+5a^2}{h}
$$

$$
= \frac{-6a^2h-6ah^2-2h^3+10ah}{h}
$$

$$
m = -6a^2-6ah-2h^2+10a
$$

$a = 2, \; h = 0$

$m = -6(2)^2 - 0 - 0 + 10(2) + 0$

$\boxed{m = -4}$

$+2ah+h^2)+2a^3-5a^2$

$+10ah+5h^2+2a^3-5a^2$

$+5h^2$

$\boxed{+5h}$

p. 21 #14a

$s(t) = -4.9t^2 + 15t + 1$

a) find avg. rate of change

$1 \le t \le 1+h$

$a = 1$

$h = h$

$$m = \frac{f(a+h) - f(a)}{h}$$

$$= \frac{-4.9(a+h)^2 + 15(a+h) + 1 + 4.9a^2}{h}$$

Warmup 2:

$$\frac{2x^2-2x-19}{x-2} < 5$$

$$\frac{2x^2-2x-19}{x-2} - 5 < 0$$

$$\boxed{\frac{-15a-1}{\quad}}$$

$$\frac{2x^2-2x-19-5(x-2)}{x-2}<0$$

$$\frac{2x^2-2x-19-5x+10}{x-2}<0$$

$$\frac{2x^2-7x-9}{x-2}<0$$

$$\frac{2x^2+2x-9x-9}{x-2}<0$$

$$\frac{2x(x+1)-9(x+1)}{x-2}<0$$

$$\frac{(x+1)(2x-9)}{(x-2)} < 0$$

	$(-\infty,-1)$	$(-1,2)$	$(2,9/2)$	$(\frac{9}{2},\infty)$
$x+1$	$-$	$+$	$+$	$+$
$2x-9$	$-$	$-$	$-$	$+$
$x-2$	$-$	$-$	$+$	$+$
Overall	neg	pos	neg	pos
Test	-5	0	3	100

$(-\infty,-1),\ (2,9/2)$

Tangent Word Problems

Avg. velocity $= \frac{\Delta d}{\Delta t}$

Inst. velocity

$$v = \frac{d(a+h) - d(a)}{h}$$

where $h \to 0$

Ex.) ∴ A toy rocket is launched straight up so that its height, d, in metres at time t in seconds is given by $d(t) = -5t^2 + 30t + 2$.

What is its velocity at $t = 4$?

$$V. = \frac{d(a+h) - d(a)}{h}$$

$$= \frac{-5(a+h)^2 + 30(a+h) + 2 + 5a^2 - 30a - 2}{h}$$

$$= \frac{-5(a+h)(a+h) + 30a + 30h + 2}{h}$$

$$= \frac{-5a^2 - 10ah - 5h^2 + 30a + 30h}{h}$$

$$= \frac{-10ah - 5h^2 + 30h}{h}$$

$$v = -10a - 5h + 30$$

$$v(4) = -10(4) + 30$$

$$\boxed{v(4) = -10}$$

$\therefore$ the speed is 10 m/s [down].

$$+5a^2 - 30a - 2$$

$$+2 + 5a^2 - 30a - 2$$

Ex. 2 ⊗⊗ : If $f(x)=\sqrt{3x-2}$, find inst. rate of change at $x=3$.

$$m=\frac{f(a+h)-f(a)}{h}$$

$$=\frac{\sqrt{3a+3h-2}-\sqrt{3a-2}}{h}\cdot\frac{\sqrt{3a+}}{\sqrt{3a+}}$$

$$=\frac{3a+3h-2+(\sqrt{3a+3h-2})(}{h(\sqrt{3a+3h-2}+\sqrt{}}$$

$$=\frac{3a+3h-2-3a+2}{h(\sqrt{3a+3h-2}+\sqrt{3a-2})}$$

$$\frac{3}{\sqrt{7}+\sqrt{7}}$$

$$\frac{\sqrt{3h-2}+\sqrt{3a-2}}{\sqrt{3h-2}+\sqrt{3a-2}}$$

$$\frac{\sqrt{3a-2})-(\sqrt{3a-2})(\sqrt{3a+3h-2})-(3a-2)}{\sqrt{3a-2})}$$

$$=\frac{3h}{h(\sqrt{3a+3h-2})+\sqrt{3a-2}}$$

$$=\frac{3}{(\sqrt{3a+3h-2}+\sqrt{3a-2}}$$

$a=3,\ h=0$

$$m=\frac{3}{(\sqrt{3(3)+0-2}+\sqrt{3(3)-2}}$$

$$m=\frac{3}{2\sqrt{7}}$$

HW p. 20

17, 19, 20abc, 23, 25

Ex. 3 · Find the inst. rate of change of $f(x) = \frac{3}{x+1}$ at $x = 3$.

$$m = \frac{f(a+h) - f(a)}{h}$$

$$= \left(\frac{3}{a+h+1} - \frac{3}{a+1} \right) \div h$$

$$= \left(\frac{3(a+1)}{(a+1)(a+h+1)} - \frac{3(a+h+1)}{(a+1)(a+h+1)} \right) \div h$$

$$= \frac{3a + 3 - 3a - 3h - 3}{(a+1)(a+h+1)} \div h$$

$$= \frac{-3h}{(a+1)(a+h+1)} \div h$$

$$= \frac{-3}{(a+1)(a+h+1)}$$

at $a = 3, h = 0$

$$= \frac{-3}{(3+1)(3+0+1)}$$

$$= \boxed{\frac{-3}{16}}$$