Find the limit (if it exists).

$$\lim_{x\to 1}\frac{\sqrt{x+3}-2}{x^2-1}\cdot\frac{\sqrt{x+3}+2}{\sqrt{x+3}+2}=\lim_{x\to 1}\frac{x-1}{(x-1)(x+1)(\sqrt{x+3}+2)}=\lim_{x\to 1}\frac{1}{(x+1)(\sqrt{x+3}+2)}=\frac{1}{(1+1)(\sqrt{1+3}+2)}=\frac{1}{2(4)}=\frac{1}{8}$$

$$\lim_{x\to 2} f(x),\quad f(x)=\begin{cases}10-x, & x\le 2\\ x^2+2x, & x>2\end{cases}$$

$\lim_{x\to 2^-} f(x)=10-2=8$; $\lim_{x\to 2^+} f(x)=2^2+2(2)=8$

11. $\left(\frac{1}{x}\right)'=(x^{-1})'=-x^{-2}=\frac{-1}{x^2}$

12. $(\ln x)'=\frac{1}{x}$

13. $(\sqrt{x})'=(x^{1/2})'=\frac{1}{2}x^{-1/2}=\frac{1}{2\sqrt{x}}$

14. $(\tan x)'=\sec^2 x$

15. $(e^x)'=e^x$

16. $(a^x)'=a^x\ln a$

17. $(x^5)'=5x^4$

18. $(7^2)'=0$

19. B
20. C
21. A

$$\frac{\Delta V}{\Delta r} = \frac{V(5) - V(2)}{5-2} = \frac{\frac{4}{3}\pi(5)^3 - \frac{4}{3}\pi(2)^3}{5-2}$$

$$V = \frac{4}{3}\pi r^3$$

$$V' = 4\pi r^2 \cdot r'$$

$$\frac{dV}{dr} = 4\pi r^2 \cdot 1$$

$$\frac{dV}{dt} = 4\pi r^2 \cdot \frac{dr}{dt}$$

22. $(xy^2)' = (x-3y)'$

$$1 \cdot y^2 + x \cdot (2y \cdot y') = 1 - 3y'$$

$$3y' + 2xyy' = 1 - y^2$$

$$y'(3+2xy) = 1 - y^2$$

$$y' = \frac{1-y^2}{3+2xy}$$

23. $(y)' = (\sin(xy))'$

$y' = [\cos(xy)] \cdot [1 \cdot y + x \cdot y']$

$y' = y\cos(xy) + xy'\cos(xy)$

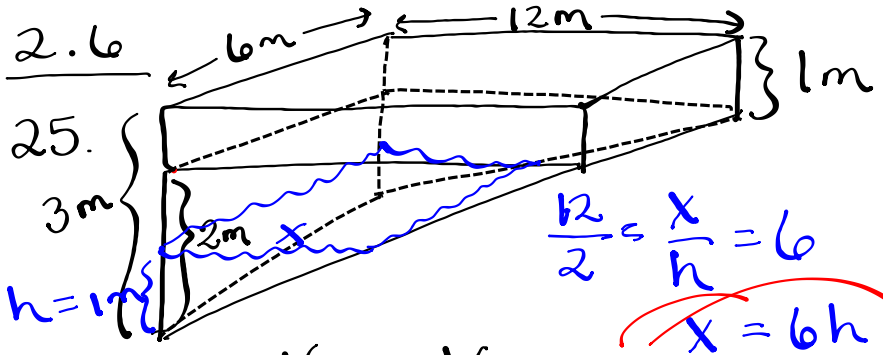
$y' - xy'\cos(xy) = y\cos(xy)$

$y'(1 - x\cos(xy)) = y\cos(xy)$

$$y' = \frac{y\cos(xy)}{1 - x\cos(xy)}$$

2.6

25.



$\frac{12}{2} = \frac{x}{h} = 6$

$x = 6h$

Total Volume $= V_{\triangle} + V_{\square}$

$= \frac{1}{2}(12)(2)(6) + 12(1)(6) = 144\ m^3$

$V_{water} = \frac{1}{2}(6)(1)(6) = 18\ m^3$

$V = \frac{1}{2}(h)(x)\cdot(6)$

$V = \frac{1}{2}(h)(6h)(6)$

$[V = 18h^2]$

$\frac{dV}{dt} = \frac{1}{4}\frac{m^3}{min}$

when $h = 1m$,

(a) what % of pool is filled?

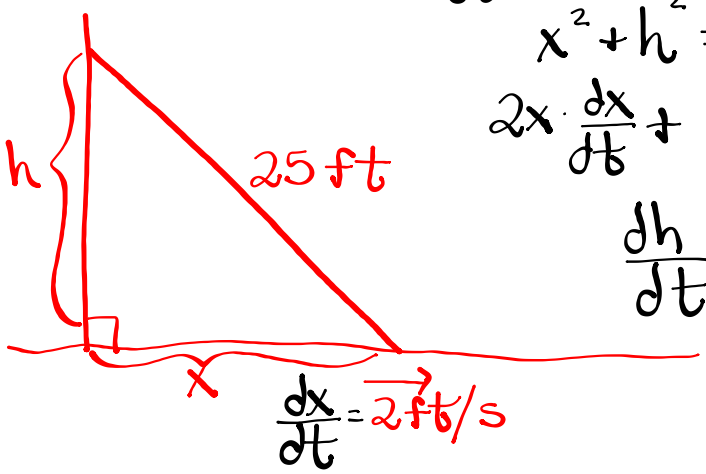
(b) $\frac{dh}{dt} = ?$

(a) $\frac{18}{144} = 12.5\%$

$\frac{dV}{dt} = 36h \cdot \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{36h} = \frac{\frac{1}{4}}{36 \cdot 1} = \left[\frac{1}{144}\frac{m}{min}\right]$

27.



(a) $\frac{dh}{dt} = ?$ when $x = 7$ ft

$h = \sqrt{25^2 - 7^2}$

$= 24$

$x^2 + h^2 = 25^2$

$2x \cdot \frac{dx}{dt} + 2h \cdot \frac{dh}{dt} = 0$

$\frac{dh}{dt} = \frac{-2x \cdot \frac{dx}{dt}}{2h} = \frac{-2(7)(2)}{2(24)}$

$= \frac{-7}{12}$ ft/s

HW #7 (due Fri, 9 Jan)
2.5 # 1-39 odd; 43, 47 - Implicit Differentiation
2.6 # 15-23 odd - Related Rates
2.6 # 25, 27, 35 - Related Rates (more challenging problems)

Quiz #4 - Fri, 9 Jan

HW #8 (due Fri, 16 Jan)
3.1 # 17-31 odd - Absolute Extrema on an Interval
3.2 # 7-19 odd - Rolle's Theorem
3.2 # 31-37 odd - Mean Value Theorem
3.3 # 11-31 odd - Increasing, Decreasing, and Relative Extrema

Quiz #5 - Fri, 16 Jan?

HW #9 (due Test Day)
3.4 #11-25 odd - Inflection Points and Concavity
3.5 #15-31 odd - Limits at Infinity

Test #3 - Wed, 21 Jan?