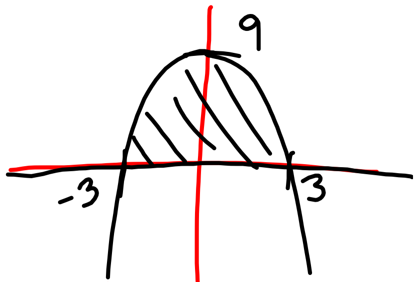
6. avg. $\frac{1}{2}$

$x=2$ (typo!)

4. $y=-x^2+9,\ y=0$

$$\int_{-3}^{3}(-x^2+9)\,dx$$



7. $\int_1^x (t+5)\,dt = \frac{1}{2}t^2+5t\Big|_1^x = \left(\frac{1}{2}x^2+5x\right)-\left(\frac{1}{2}+5\right)$

$$=\boxed{\frac{1}{2}x^2+5x-\frac{11}{2}}$$

6. $\frac{1}{4-1}\int_1^4 \frac{x^2-2}{x^2}\,dx = \frac{1}{2}$

$$\int_a^b f(x)\,dx = f(c)\cdot(b-a)$$

$$\frac{1}{2}=\frac{x^2-2}{x} \Rightarrow x=2$$

$$\frac{1}{4-1}\int_1^4 \frac{x^2-2}{x^2}\,dx$$

$$=\frac{1}{3}\int_1^4 (1-2x^{-2})\,dx = \frac{1}{3}\left(x+2x^{-1}\right)\Big|_1^4$$

$$=\frac{1}{3}\left(4+\cancel{\tfrac{2}{4}}^{\,\frac{1}{2}}\right)-\frac{1}{3}(1+2)$$

$$=\frac{4}{3}+\frac{1}{6}-1$$

$$=\frac{8}{6}+\frac{1}{6}-\frac{6}{6}=\frac{3}{6}=\frac{1}{2}$$

13. $$\int_0^{\pi/3} \sin x\cos x\,dx = \int_{x=0}^{x=\frac{\pi}{3}} u\,du$$

$u = \sin x$

$du = \cos x\,dx$

$$=\frac{u^2}{2}\Big|_{x=0}^{x=\pi/3}$$

$$=\frac{(\sin x)^2}{2}\Big|_0^{\pi/3}$$

$$=\frac{(\sin\frac{\pi}{3})^2}{2}-0=\frac{\left(\frac{\sqrt{3}}{2}\right)^2}{2}=\boxed{\frac{3}{8}}$$

15. $\int \tan 3x\,dx = \int \frac{\sin 3x\,dx}{\cos 3x} = -\frac{1}{3}\int \frac{du}{u}$

$u = \cos 3x$

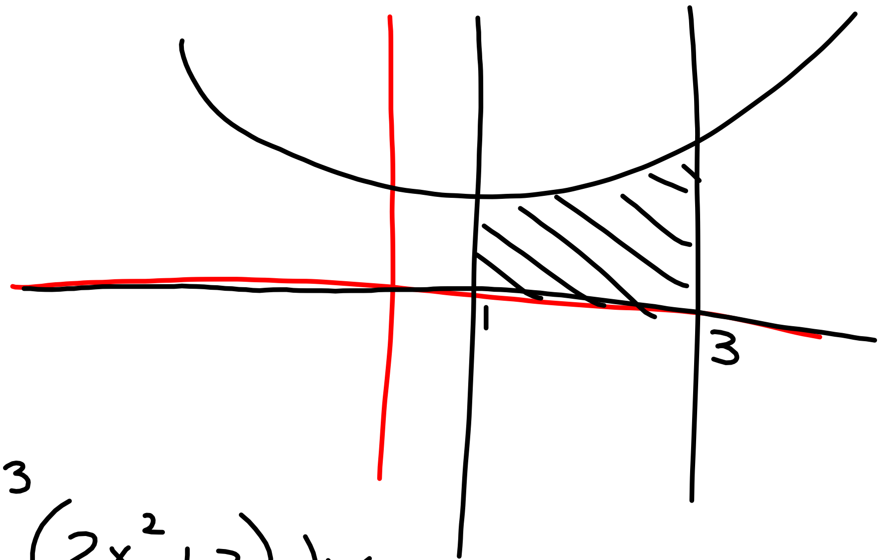
$du = -\sin 3x \cdot 3 \cdot dx$

$-\frac{du}{3} = \sin 3x\,dx$

$= -\frac{1}{3}\ln|u| + c$

$= \boxed{-\frac{1}{3}\ln|\cos 3x| + c}$

3. $y = 2x^2 + 2$, $x = 1$, $x = 3$, $y = 0$



$\int_1^3 (2x^2 + 2)\,dx$

5. $f(x)=\frac{9}{x^3}$, $[1,3]$

$$\int_1^3 (9x^{-3})\,dx = \frac{9}{c^3}(3-1)$$

$$-\frac{9}{2}x^{-2}\Big|_1^3 = \frac{18}{c^3}$$

$$\frac{-9}{2(3)^2} - \frac{-9}{2\cdot 1^2} = \frac{18}{c^3}$$

$$-\frac{1}{2}+\frac{9}{2}=\frac{18}{c^3}$$

$$4=\frac{18}{c^3}$$

$$c^3=\frac{18}{4}$$

$$\boxed{c=\sqrt[3]{18/4}}=\sqrt[3]{\frac{9}{2}}$$

Bonus B

$$\int_2^3 \frac{2x-3}{\sqrt{4x-x^2}}\,dx = \int\frac{2x}{\sqrt{4x-x^2}}\,dx - \int\frac{3}{\sqrt{4x-x^2}}\,dx$$

$-(x^2-4x+4)+4$

$2^2-(x-2)^2$

$\int\frac{1\,du}{\sqrt{a^2-u^2}}=\arcsin\frac{u}{a}+c$

$$\underbrace{\int\frac{2x\,dx}{\sqrt{4x-x^2}}} - \underbrace{\int\frac{3\,dx}{\sqrt{2^2-(x-2)^2}}}_{-3\arcsin\frac{x-2}{2}}$$

$u=x-2$
$a=2$

$u=4x-x^2$
$du=(4-2x)dx$
$-du=(2x-4)dx$

$$\int\frac{(2x-4+4)dx}{\sqrt{4x-x^2}}$$

$$\underbrace{\int\frac{(2x-4)dx}{\sqrt{4x-x^2}}}_{\int -u^{-1/2}du} + \underbrace{\int\frac{4\,dx}{\sqrt{4x-x^2}}}_{4\arcsin\frac{x-2}{2}}$$

$-2u^{1/2}$

$$=-2\sqrt{4x-x^2}+4\arcsin\frac{x-2}{2}-3\arcsin\frac{x-2}{2}$$

$$=\left(-2\sqrt{4x-x^2}+\arcsin\frac{x-2}{2}\right)\Big|_2^3=$$

$$=\left(-2\sqrt{3}+\frac{\pi}{6}\right)-\left(-4-0\right)=\boxed{-2\sqrt{3}+\frac{\pi}{6}+4}$$

$$u = 2 + 2^x$$

$$du = 2^x \cdot \ln 2 \cdot \partial x$$

$$\frac{du}{\ln 2} = 2^x \partial x$$