Differentieren **Antwoorden versie 4**

1.1

a $\frac{\partial}{\partial x}\left(11\cdot x^{3}\right) = 33\cdot x^{2}$

b $\frac{\partial}{\partial x}\left(x^{3} - 11\right) = 3\cdot x^{2}$

c $\frac{\partial}{\partial x}\left(x^{3} + 11\cdot x\right) = 3\cdot x^{2} + 11$

d $\frac{\partial}{\partial x}\left(3 - x^{11}\right) = -11\cdot x^{10}$

e $\frac{\partial}{\partial x}\left(5\cdot \sin(x)\right) = 5\cdot \cos(x)$

f $\frac{\partial}{\partial x}\left(\sin(x) + 5\right) = \cos(x)$

g $\frac{\partial}{\partial x}\left(\sin(x + 5)\right) = \cos(x + 5)$

h $\frac{\partial}{\partial x}\left(\sin(5\cdot x)\right) = 5\cdot \cos(5\cdot x)$

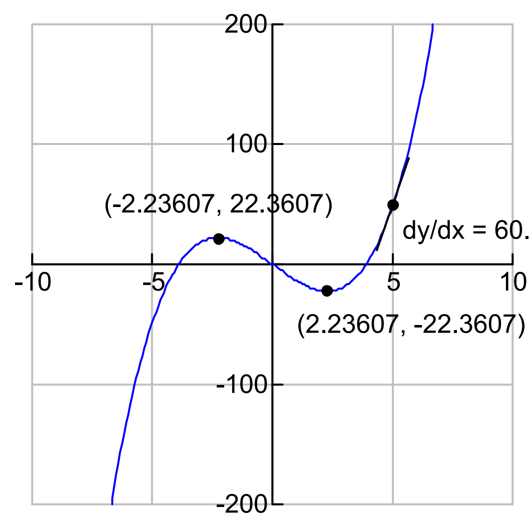
i $\frac{\partial}{\partial x}\left(1000\cdot x^{10} - 10\right) = 10000\cdot x^{9}$

j $\frac{\partial}{\partial x}\left(\frac{1}{2}\cdot x^{4} + \frac{3}{4}\cdot x^{2} + \frac{1}{3}\right) = 2\cdot x^{3} + \frac{3\cdot x}{2}$

k $\frac{\partial}{\partial x}\left(\cos(x) + \sin(2\cdot x)\right) = 2\cdot \cos(2\cdot x) - \sin(x)$

l $\frac{\partial}{\partial x}\left(\frac{2}{3}\cdot x - \cos\left(\frac{1}{3}\cdot x\right)\right) = \frac{\sin\left(\frac{x}{3}\right)}{3} + \frac{2}{3}$

1.2



1.8 $f(x) := x^2$

a $\dfrac{f(8.01) - f(8)}{.01} = 16.01$

b $\dfrac{f(6.001) - f(6)}{.001} = 12.001$

c $\dfrac{f(-3.9999) - f(-4)}{-3.9999 - -4} = -7.9999$

d $\dfrac{f(-2.0001) - f(-2)}{-2.0001 - -2} = -4.0001$

$f(x) := 0.25 \cdot x^4$

1.9

a $\dfrac{\partial}{\partial x}\left(0.25 \cdot x^4\right) = x^3$

b $ans \mid x = 2 \quad = 8$

c $\dfrac{f(10.1) - f(10)}{.1} = 1015.1$

$v(r) := \dfrac{4}{3} \cdot \pi \cdot r^3$

1.10

a $\dfrac{\partial}{\partial r}(v(r)) = 4 \cdot \pi \cdot r^2$

b $ans \mid r = 20 \quad = 1600 \cdot \pi$

1.11

a $\dfrac{\partial}{\partial x}\left(x^2 + \cos(x)\right) = 2 \cdot x - \sin(x)$

b $\dfrac{\partial}{\partial x}\left(\dfrac{3}{4} \cdot x^4 - \dfrac{4}{3} \cdot x^6\right) = 3 \cdot x^3 - 8 \cdot x^5$

c $\dfrac{\partial}{\partial q}\left(q^8 - q^5 - 85\right) = 8 \cdot q^7 - 5 \cdot q^4$

d $\dfrac{\partial}{\partial t}(10 \cdot t + 20 \cdot t + 30 \cdot \sin(t)) = 30 \cdot \cos(t) + 30$

1.12 $\frac{\partial}{\partial x}\left(x^2 \cdot x^3\right) \quad = 5 \cdot x^4$

1.13

1.14

1.15

1.16

a $\frac{\partial}{\partial x}(3 \cdot \sin(x)) \quad = 3 \cdot \cos(x)$

b $\frac{\partial}{\partial x}(5 \cdot \sin(x)) \quad = 5 \cdot \cos(x)$

c $\frac{\partial}{\partial x}(8.5 \cdot \sin(x)) \quad = 8.5 \cdot \cos(x)$

d $\frac{\partial}{\partial x}\left(7 \cdot x\text{®}\left(\frac{1}{4} \cdot x\text{®} + 17\right)\right) \quad = 7 \cdot x \cdot \left(x^2 + 34\right)$

e $\frac{\partial}{\partial x}(7 \cdot x\text{®}\sin(x)) \quad = 7 \cdot x^2 \cdot \cos(x) + 14 \cdot x \cdot \sin(x)$

f $\frac{\partial}{\partial x}\left((2 + 3 \cdot x) \cdot \left(4 - 5 \cdot x + 6 \cdot x^2\right)\right) \quad = 54 \cdot x^2 - 6 \cdot x + 2$

1.17

$p(x) := (5 \cdot x\text{®} + 1) \cdot \left(4 \cdot x^3 + 1\right)$

$\frac{\partial}{\partial x}(p(x)) \quad = 2 \cdot x \cdot \left(50 \cdot x^3 + 6 \cdot x + 5\right)$

1.18

a $\frac{\partial}{\partial x}\left(x^2 + 2 \cdot x + 3\right)^2 \quad = 4 \cdot (x + 1) \cdot \left(x^2 + 2 \cdot x + 3\right) \; ans \mid x = 1 \quad = 122$

b $\frac{\partial}{\partial x}(\sin(x)\text{®}) \quad = 2 \cdot \sin(x) \cdot \cos(x) \quad ans \mid x = \frac{1}{4} \cdot \pi \quad = 1$

c $\frac{d}{dx}\left(x - (\sin(x))^2\right) \quad = 1 - 2 \cdot \sin(x) \cdot \cos(x) \quad ans \mid x = \frac{1}{2} \cdot \pi \quad = 1$

1.19

$$\frac{\partial}{\partial x} x^2 = 2\cdot x$$

$$\frac{\partial}{\partial x} (\cos(x)) = -\sin(x)$$

$$\frac{\partial}{\partial x} (x^2 + \cos(x)) = 2\cdot x - \sin(x)$$

$$\frac{\partial}{\partial x} (x^2 - \cos(x)) = \sin(x) + 2\cdot x$$

$$\frac{\partial}{\partial x} (x\cdot\sin(x)) = x\cdot\cos(x) + \sin(x)$$

$$\frac{\partial}{\partial x} (x^2 + x\cdot\sin(x)) = x\cdot\cos(x) + \sin(x) + 2\cdot x$$

$$\frac{\partial}{\partial x} ((x^2 + x)\cdot\sin(x)) = (x^2 + x)\cdot\cos(x) + (2\cdot x + 1)\cdot\sin(x)$$

1.20

1.21

a

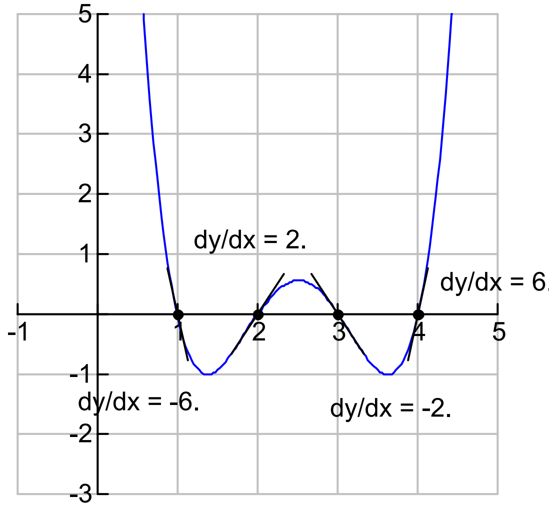
$$\frac{\partial}{\partial x} ((x^2 + 1)\cdot(x^3 + 2)\cdot(x^4 + 3)) = x\cdot(9\cdot x^7 + 7\cdot x^5 + 12\cdot x^4 + 15\cdot x^3 + 8\cdot x^2 + 9\cdot x + 12)$$

b $\frac{\partial}{\partial x} (x\cdot\sin(x)\cdot\cos(x)) = 2\cdot x\cdot(\cos(x))^2 + \sin(x)\cdot\cos(x) - x$

c $\frac{\partial}{\partial x} (\cos(x))^3 = -3\cdot\sin(x)\cdot(\cos(x))^2$

1.22

1.23



c 3

1.24 $f(x) := (2 \cdot x + 1)^4$

$\frac{¶}{¶x}(f(x)) \qquad = 8 \cdot (2 \cdot x + 1)^3$

$ans \mid x = -1 \qquad = -8$

1.3.2

a $\frac{¶}{¶x}((1 - x) \cdot (1 + x) \cdot (1 + x®)) \qquad = -4 \cdot x^3$

$ans \mid x = 1 \qquad = -4$

b

1.25

b $\frac{5.01^{-1} - 4.99^{-1}}{5.01 - 4.99} \qquad = -.04$

c $\text{approx}(-1 \cdot 5^{-2}) \qquad = -.04$

1.26

1.27 c $\frac{\P}{\P x}\frac{1}{x^4} \quad = \frac{-4}{x^5}$

1.28 b $\quad$ x = 0, y = 0

d $\quad \frac{\P}{\P x}\frac{1}{x\text{®}} \quad = \frac{-2}{x^3}$

$\frac{-2}{x^3} \mid x = \frac{1}{2} \quad = -16$

$y = -16 \cdot x + 12$

B: $\text{solve}(0 = -16 \cdot x + 12, x) \quad x = \frac{3}{4}$

$\frac{-2}{x^3} \mid x = \frac{-(1)}{2} \quad = 16$

$y = 16 \cdot x + 12$

C: $\text{solve}(0 = 16 \cdot x + 12, x) \quad x = \frac{-3}{4}$

$oppABC = \frac{3}{4} \cdot 12 \quad oppabc = 9$

1.29

1.30 b $\quad \frac{\P}{\P x}\left(\sqrt[4]{x}\right) \quad = \frac{1}{4 \cdot x^{3/4}}$

$\frac{\P}{\P x}\left(\sqrt[5]{x}\right) \quad = \frac{1}{5 \cdot x^{4/5}}$

1.31 $\quad \frac{\P}{\P x}\left(\sqrt[2]{x}\right) \quad = \frac{1}{2 \cdot \sqrt{x}}$

$\text{solve}(ans = 1, x) \quad x = \frac{1}{4}$

1.32

1.33 a $\frac{\partial}{\partial x}\left(\sqrt[4]{x^3}\right) \quad = \frac{3\cdot x^2}{4\cdot\left(x^3\right)^{3/4}}$

b $\frac{\partial}{\partial x}\frac{5}{x^3} \quad = \frac{-15}{x^4}$

c $\frac{\partial}{\partial x}\left(10\cdot x^{.2}\right) \quad = \frac{2.}{x^{.8}}$

d $\frac{\partial}{\partial x}\left(0.2\cdot x^{10}\right) \quad = 2.\cdot x^9$

e $\frac{\partial}{\partial x}\left(\frac{1}{x^2}+\frac{4}{x}\right) \quad = \frac{-4}{x^2} - \frac{2}{x^3}$

f $\frac{\partial}{\partial x}\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right) \quad = \frac{1}{2\cdot\sqrt{x}} - \frac{1}{2\cdot x^{3/2}}$

1.34 a $\frac{\partial}{\partial x}\frac{x^3+1}{x} \quad = \frac{2\cdot x^3 - 1}{x^2}$

b $\frac{\partial}{\partial x}\frac{x^3+1}{x^2} \quad = \frac{x^3 - 2}{x^3}$

c $\frac{\partial}{\partial x}\frac{x^2 - x + 1}{\sqrt{x}} \quad = \frac{3\cdot x^2 - x - 1}{2\cdot x^{3/2}}$

d $\frac{\partial}{\partial x}\frac{x^3 + 4\cdot x^2 - 3\cdot x}{x\cdot\sqrt{x}} \quad = \frac{3\cdot x^2 + 4\cdot x + 3}{2\cdot x^{3/2}}$

1.35

1.36 $\frac{\partial}{\partial x}\frac{1}{x} \quad = \frac{-1}{x^2}$

$\frac{\partial}{\partial x}\sqrt{x} \quad = \frac{1}{2\sqrt{x}}$

1.37 a $\frac{\P}{\P x}\sqrt{x^5} \quad = \frac{5 \cdot x^4}{2 \cdot \sqrt{x^5}}$

$ans \mid x = 1 \quad = \frac{5}{2}$

b $\frac{\P}{\P x}\left(\sqrt{x}^5\right) \quad = \frac{5 \cdot x^{3/2}}{2}$

$ans \mid x = 4 \quad = 20$

c $\frac{\P}{\P x}\left(x \cdot \sqrt[2]{x}\right) \quad = \frac{3 \cdot \sqrt{x}}{2}$

$ans \mid x = 9 \quad = \frac{9}{2}$

d $\frac{\P}{\P x}\frac{\sqrt{x}}{x^{®}} \quad = \frac{-3}{2 \cdot x^{5/2}}$

$ans \mid x = 9 \quad = \frac{-1}{162}$

1.38

1.39

1.40 a $w = 4 \cdot \sqrt[2]{q} - q^{2/3} \qquad w = 4 \cdot \sqrt{q} - q^{2/3}$

$\frac{\P}{\P q}\left(4 \cdot \sqrt{q} - q^{2/3}\right) \quad = \frac{2}{\sqrt{q}} - \frac{2}{3 \cdot \sqrt[3]{q}}$

$\text{solve}(ans = 0, q) \quad q = 729$

1.41 b $2 \cdot x \cdot x + \frac{2 \cdot 2 \cdot x \cdot 18}{x^{®}} + \frac{2 \cdot x \cdot 18}{x^{®}} \quad = 2 \cdot x^2 + \frac{108}{x}$

c $\frac{\P}{\P x}\left(2 \cdot x^{®} + \frac{108}{x}\right) \quad = 4 \cdot x - \frac{108}{x^2}$

d $\text{solve}\left(4 \cdot x - \frac{108}{x^{®}} = 0, x\right) \quad x = 3$

1.42

$$\frac{\partial}{\partial x}\frac{1}{\sqrt[3]{x}} = \frac{-1}{3\cdot x^{4/3}}$$

$$\frac{\partial}{\partial x}\sqrt{x^{-1}} = \frac{-1}{2\cdot\sqrt{\frac{1}{x}}\cdot x^{2}}$$

$$\frac{\partial}{\partial x}\left(\frac{1}{x}\cdot\sqrt[4]{x}\right) = \frac{-3}{4\cdot x^{7/4}}$$

$$\frac{\partial}{\partial x}\sqrt{\sqrt{\sqrt{x}}} = \frac{1}{8\cdot x^{7/8}}$$

$$\frac{\partial}{\partial x}\frac{1}{x\cdot\sqrt{x}} = \frac{-3}{2\cdot x^{5/2}}$$

$$\frac{\partial}{\partial x}\frac{1}{x^{-3}} = 3\cdot x^{2}$$

$$\frac{\partial}{\partial x}\left(10\cdot x^{0.7}\right) = \frac{7.}{x^{.3}}$$

$$\frac{\partial}{\partial x}\frac{12}{x^{0.3}} = \frac{-3.6}{x^{1.3}}$$

$$\frac{\partial}{\partial x}\frac{x+1}{\sqrt{x}} = \frac{x-1}{2\cdot x^{3/2}}$$

$$\frac{\partial}{\partial x}\sqrt{x}^{-3} = \frac{-3}{2\cdot x^{5/2}}$$

$$\frac{\partial}{\partial x}\left(\sqrt[3]{x^{-8}}\right) = \frac{-8}{3\cdot x^{11/3}}$$

$$\frac{\partial}{\partial x}\left(\frac{1}{x}+\sin(x)\right) = \cos(x) - \frac{1}{x^{2}}$$

$$\frac{\partial}{\partial x}\left(\frac{1}{x}\cdot\sin(x)\right) = \frac{\cos(x)}{x} - \frac{\sin(x)}{x^{2}}$$

$$\frac{\partial}{\partial x}\left(\frac{2}{\sqrt{x}}\cdot\cos(x)\right) = \frac{-\cos(x)}{x^{3/2}} - \frac{2\cdot\sin(x)}{\sqrt{x}}$$

$$\frac{\partial}{\partial x}\frac{2\cdot\cos(x)}{\sqrt{x}} = \frac{-\cos(x)}{x^{3/2}} - \frac{2\cdot\sin(x)}{\sqrt{x}}$$

1.43

1.44 $\frac{\partial}{\partial x}\left(\sqrt{x^2+64}\right) \quad = \frac{x}{\sqrt{x^2+64}}$

$ans \mid x = 4 \quad = \frac{\sqrt{5}}{5}$

$\frac{x}{\sqrt{x^2+64}} \mid x = 9 \quad = \frac{9\cdot\sqrt{145}}{145}$

1.45

1.46

1.47

1.48

1.49 a $\frac{\partial}{\partial x}(5\cdot x+2)^3 \quad = 15\cdot(5\cdot x+2)^2$

b $\frac{\partial}{\partial x}\left(\sqrt{4-x}\right) \quad = \frac{-1}{2\cdot\sqrt{4-x}}$

c $\frac{\partial}{\partial x}\left(2-\sqrt{x}\right)^{-1} \quad = \frac{1}{2\sqrt{x}\cdot\left(\sqrt{x}-2\right)^2}$

1.50 a $\frac{\partial}{\partial x}(\cos(x))^3 \quad = -3\cdot\sin(x)\cdot(\cos(x))^2$

b $\frac{\partial}{\partial x}\frac{1}{(\cos(x))^2} \quad = \frac{2\cdot\sin(x)}{(\cos(x))^3}$

c $\frac{\partial}{\partial x}\left(\sqrt[3]{\sin(x)}\right) \quad = \frac{\cos(x)}{3\cdot(\sin(x))^{2/3}}$

1.51

1.52

a $\frac{\partial}{\partial x}(x+4)^3 = 3\cdot(x+4)^2$

b $\frac{\partial}{\partial x}(\sin(x))^3 = 3\cdot(\sin(x))^2\cdot\cos(x)$

c $\frac{\partial}{\partial x}\left(\frac{1}{1+2\cdot x}\right)^3 = \frac{-6}{(2\cdot x+1)^4}$

d $\frac{\partial}{\partial x}\left(\sqrt[3]{1-x}\right)^3 = -1$

1.53

a $\frac{\partial}{\partial x}\left(\sqrt{x^2-4\cdot x}+5\cdot x\right) = \frac{x-2}{\sqrt{x\cdot(x-4)}}+5$

b $\frac{\partial}{\partial x}\left(\sqrt{x^2-4\cdot x}-5\cdot x\right) = \frac{x-2}{\sqrt{x\cdot(x-4)}}-5$

c $\frac{\partial}{\partial x}\left(5\cdot x-\sqrt{x^2-4\cdot x}\right) = 5-\frac{x-2}{\sqrt{x\cdot(x-4)}}$

d $\frac{\partial}{\partial x}\left(5\cdot x\cdot\sqrt{x^2-4\cdot x}\right) = 5\sqrt{x\cdot(x-4)}+\frac{5\cdot x\cdot(x-2)}{\sqrt{x\cdot(x-4)}}$

1.54

a $\frac{\partial}{\partial x}\left(\sin(x^2)+\cos(x^3)\right) = 2\cdot x\cdot\cos(x^2)-3\cdot x^2\cdot\sin(x^3)$

b

$$\frac{\partial}{\partial x}\left(\sin(x^2)\cdot\cos(x^3)\right) = 2\cdot x\cdot\cos(x^2)\cdot\cos(x^3)-3\cdot x^2\cdot\sin(x^2)\cdot\sin(x^3)$$

c $\frac{\partial}{\partial x}\left(\sin(x)\cdot\sqrt{\cos(x)}\right) = \frac{3\cdot(\cos(x))^2-1}{2\sqrt{\cos(x)}}$

d $\frac{\partial}{\partial x}\left(\sqrt{\sin(x)\cdot\cos(x)}\right) = \frac{2\cdot(\cos(x))^2-1}{2\sqrt{\sin(x)\cdot\cos(x)}}$

1.55

$$\frac{\P}{\P x}\left(5\cdot\sqrt{9+x®}+30-7.5\cdot x\right) \qquad = \frac{5\cdot x}{\sqrt{x^2+9}}-7.5$$

1.56 d

$$\text{solve}(ans=0,\ x) \qquad = false$$

1.57

a $$\frac{\P}{\P x}\left((\sin(x))^3\cdot(x®+1)\right) \qquad = 3\cdot\left(x^2+1\right)\cdot(\sin(x))^2\cdot\cos(x)+2\cdot x\cdot(\sin(x))^3$$

b $$\frac{\P}{\P x}\left(\sqrt{\sin\left(\frac{1}{x}\right)}\right) \qquad = \frac{-\cos\left(\frac{1}{x}\right)}{2\cdot\sqrt{\sin\left(\frac{1}{x}\right)}\cdot x^2}$$

c $$\frac{\P}{\P x}\left(\sqrt[4]{\cos(\sqrt{x})}\right) \qquad = \frac{-\sin(\sqrt{x})}{8\cdot(\cos(\sqrt{x}))^{3/4}\cdot\sqrt{x}}$$

d $$\frac{\P}{\P x}\frac{1}{\sin\left(\frac{1}{x}\right)} \qquad = \frac{\cos\left(\frac{1}{x}\right)}{\left(\sin\left(\frac{1}{x}\right)\right)^2\cdot x^2}$$

1.5.2 a

$$\frac{\P}{\P x}(x®+1)^4 \qquad = 8\cdot x\cdot\left(x^2+1\right)^3$$

$$\frac{\P}{\P x}\left(\sqrt[4]{x®+1}\right) \qquad = \frac{x}{2\cdot\left(x^2+1\right)^{3/4}}$$

$$\frac{\P}{\P x}\frac{1}{(x®+1)^4} \qquad = \frac{-8\cdot x}{\left(x^2+1\right)^5}$$

b $$\frac{\P}{\P x}(\sin(5\cdot x))^3 \qquad = 15\cdot(\sin(5\cdot x))^2\cdot\cos(5\cdot x)$$

$$ans \mid x=0.05\cdot\pi \qquad = 5.3033$$

1.58 a

$$\frac{x+5}{x}\mid x=5 \qquad \Rightarrow 2$$

$$\frac{x+5}{x}\mid x=10 \qquad \Rightarrow \frac{3}{2}$$

$$\frac{x+5}{x}\mid x=20 \qquad \Rightarrow \frac{5}{4}$$

$\text{solve}\left(\frac{x+5}{x} = \frac{11}{10}, x\right) \qquad x = 50$

b

c

1.59 a $f(x) = \frac{x+1}{x}$

b \

c y = 1, x = 0

1.60 a

b $\frac{\P}{\P x}\frac{5}{x} \qquad = \frac{-5}{x^2}$

$\frac{\P}{\P x}\frac{x+5}{x} \qquad = \frac{-5}{x^2}$

1.61 c x = 0, y = 1,5

1.62 a f: x = 0, y = 0

g: x = 2, y = 0

c $\frac{\P}{\P x}\frac{6}{x} \qquad = \frac{-6}{x^2}$

$\frac{\P}{\P x}\frac{6}{x-2} \qquad = \frac{-6}{(x-2)^2}$

1.63

1.64

1.65 c $\frac{\P}{\P x}\left(2 + \frac{1}{x-3}\right) \qquad = \frac{-1}{(x-3)^2}$

$ans \mid x = 1 \qquad = \frac{-1}{4}$

1.66 a $x = -1,\ y = 3$

b $x = -1,\ y = 2$

c $x = -1,\ y = 1$

d $x = -0{,}5;\ y = 2$

1.67 a

1.68 $$\frac{\partial}{\partial x}\frac{3\cdot x+4}{2\cdot x-5} = \frac{-23}{(2\cdot x-5)^2}$$

1.69

1.70

1.71 a $$\frac{\partial}{\partial x}\frac{x^2+1}{3\cdot x+1} = \frac{3\cdot x^2+2\cdot x-3}{(3\cdot x+1)^2}$$

b $$\frac{\partial}{\partial x}\frac{x}{\sin(x)} = \frac{-(x\cdot\cos(x)-\sin(x))}{(\sin(x))^2}$$

c $$\frac{\partial}{\partial x}\frac{3\cdot x^2+x+1}{2\cdot x^2-x+1} = \frac{-(5\cdot x^2-2\cdot x-2)}{(2\cdot x^2-x+1)^2}$$

d $$\frac{\partial}{\partial x}\frac{3\cdot x-4}{4\cdot x-5} = \frac{1}{(4\cdot x-5)^2}$$

e $$\frac{\partial}{\partial x}\frac{4\cdot x}{x^2+1} = \frac{-4\cdot(x^2-1)}{(x^2+1)^2}$$

f $$\frac{\partial}{\partial x}\frac{x^2+1}{4\cdot x} = \frac{x^2-1}{4\cdot x^2}$$

g $$\frac{\partial}{\partial x}\frac{\sqrt{x}+2}{\sqrt{x}-2} = \frac{-2}{\sqrt{x}\cdot(\sqrt{x}-2)^2}$$

h $$\frac{\partial}{\partial x}\frac{\cos(x)}{x^2} = \frac{-2\cdot\cos(x)}{x^3} - \frac{\sin(x)}{x^2}$$

1.72 $\frac{\partial}{\partial x}\frac{3}{x^2-3} = \frac{-6\cdot x}{\left(x^2-3\right)^2}$

$\frac{\partial}{\partial x}\frac{x^2}{x^3-3} = \frac{-x\cdot\left(x^3+6\right)}{\left(x^3-3\right)^2}$

1.73 $\frac{\partial}{\partial x}\frac{x^2+x+1}{x^2+1} = \frac{-\left(x^2-1\right)}{\left(x^2+1\right)^2}$

$ans \mid x=0 \quad = 1$

y = x + 1

1.74

a $\frac{\partial}{\partial x}\frac{6\cdot x}{x^2+1} = \frac{-6\cdot\left(x^2-1\right)}{\left(x^2+1\right)^2}$

$\text{solve}(ans=0,\ x) \quad x=1 \text{ or } x=-1$

b $\frac{\partial}{\partial x}\left(\frac{\partial}{\partial x}\frac{6\cdot x}{x^2+1}\right) = \frac{12\cdot x\cdot\left(x^2-3\right)}{\left(x^2+1\right)^3}$

$\text{solve}(ans=0,\ x) \quad x=-\sqrt{3} \text{ or } x=\sqrt{3} \text{ or } x=0$

c

1.75 $\frac{\partial}{\partial x}\frac{136\cdot x^2}{x^4+16} = \frac{-272\cdot x\cdot\left(x^4-16\right)}{\left(x^4+16\right)^2}$

$\text{solve}(ans=0,\ x) \quad x=2 \text{ or } x=0 \text{ or } x=-2$

1.76

a $r = 0.0075\cdot v^2 \mid v=60 \quad r=27.$

b $1\frac{(km)}{min}$ --> $\text{approx}\left(\frac{1000}{31}\right) = 32.2581$

c $r = 0.0075\cdot v^2 \mid v=120 \quad r=108.$

$\text{approx}\left(\frac{1000}{112}\right) = 8.92857$

d

e $\frac{\partial}{\partial v}\frac{1000\cdot v}{0.45\cdot v^2+240} = \frac{-2222.22\cdot\left(v^2-533.333\right)}{\left(v^2+533.333\right)^2}$

$\text{solve}(ans=0,\ v) \quad v=23.094 \text{ or } v=-23.094$

1.7.2 a

$$\frac{\P}{\P x}\,\frac{x^2+3}{x+1} = \frac{x^2+2\cdot x-3}{(x+1)^2}$$

$$\frac{\P}{\P x}\,\frac{x\text{®}+x+4}{x+1} = \frac{x^2+2\cdot x-3}{(x+1)^2}$$

1.77 d

$$\sin\left(\left(\frac{1}{6}\cdot\pi\right)\right) = \frac{1}{2} \qquad \sin\left(\left(\frac{1}{4}\cdot\pi\right)\right) = \frac{\sqrt{2}}{2}$$

$$\sin\left(\left(\frac{1}{3}\cdot\pi\right)\right) = \frac{\sqrt{3}}{2}$$

$$\sin\left(\left(\frac{2}{3}\cdot\pi\right)\right) = \frac{\sqrt{3}}{2} \qquad \sin\left(\left(\frac{3}{4}\cdot\pi\right)\right) = \frac{\sqrt{2}}{2} \qquad \sin\left(\left(\frac{5}{6}\cdot\pi\right)\right) = \frac{1}{2}$$

$$\sin\left(\left(\frac{7}{6}\cdot\pi\right)\right) = \frac{-1}{2} \qquad \sin\left(\left(\frac{5}{4}\cdot\pi\right)\right) = \frac{-\sqrt{2}}{2}$$

$$\sin\left(\left(\frac{4}{3}\cdot\pi\right)\right) = \frac{-\sqrt{3}}{2} \qquad \cos\left(\left(\frac{1}{6}\cdot\pi\right)\right) = \frac{\sqrt{3}}{2}$$

$$\cos\left(\left(\frac{1}{4}\cdot\pi\right)\right) = \frac{\sqrt{2}}{2} \qquad \cos\left(\left(\frac{1}{3}\cdot\pi\right)\right) = \frac{1}{2}$$

$$\cos\left(\left(\frac{2}{3}\cdot\pi\right)\right) = \frac{-1}{2} \qquad \cos\left(\left(\frac{3}{4}\cdot\pi\right)\right) = \frac{-\sqrt{2}}{2}$$

$$\cos\left(\left(\frac{5}{6}\cdot\pi\right)\right) = \frac{-\sqrt{3}}{2}$$

$$\cos\left(\left(\frac{7}{6}\cdot\pi\right)\right) = \frac{-\sqrt{3}}{2} \qquad \cos\left(\left(\frac{5}{4}\cdot\pi\right)\right) = \frac{-\sqrt{2}}{2}$$

$$\cos\left(\left(\frac{4}{3}\cdot\pi\right)\right) = \frac{-1}{2} \qquad \frac{\sin\left(\left(\frac{1}{6}\cdot\pi\right)\right)}{\cos\left(\left(\frac{1}{6}\cdot\pi\right)\right)} = \frac{\sqrt{3}}{3}$$

$$\frac{\sin\left(\left(\frac{1}{4}\cdot\pi\right)\right)}{\cos\left(\left(\frac{1}{4}\cdot\pi\right)\right)} = 1 \qquad \frac{\sin\left(\left(\frac{1}{3}\cdot\pi\right)\right)}{\cos\left(\left(\frac{1}{3}\cdot\pi\right)\right)} = \sqrt{3}$$

$$\frac{\sin\left(\left(\frac{2}{3}\cdot\pi\right)\right)}{\cos\left(\left(\frac{2}{3}\cdot\pi\right)\right)} = -\sqrt{3} \qquad \frac{\sin\left(\left(\frac{3}{4}\cdot\pi\right)\right)}{\cos\left(\left(\frac{3}{4}\cdot\pi\right)\right)} = -1 \qquad \frac{\sin\left(\left(\frac{5}{6}\cdot\pi\right)\right)}{\cos\left(\left(\frac{5}{6}\cdot\pi\right)\right)} = \frac{-\sqrt{3}}{3}$$

$$\frac{\sin\left(\left(\frac{7}{6}\cdot\pi\right)\right)}{\cos\left(\left(\frac{7}{6}\cdot\pi\right)\right)} = \frac{\sqrt{3}}{3} \qquad \frac{\sin\left(\left(\frac{5}{4}\cdot\pi\right)\right)}{\cos\left(\left(\frac{5}{4}\cdot\pi\right)\right)} = 1 \qquad \frac{\sin\left(\left(\frac{4}{3}\cdot\pi\right)\right)}{\cos\left(\left(\frac{4}{3}\cdot\pi\right)\right)} = \sqrt{3}$$

e $$\frac{\sin\left(\left(\frac{-1}{6}\cdot\pi\right)\right)}{\cos\left(\left(\frac{-1}{6}\cdot\pi\right)\right)} = \frac{-\sqrt{3}}{3} \qquad \frac{\sin\left(\left(\frac{-1}{4}\cdot\pi\right)\right)}{\cos\left(\left(\frac{-1}{4}\cdot\pi\right)\right)} = -1$$

$$\frac{\sin\left(\left(\frac{-1}{5}\cdot\pi\right)\right)}{\cos\left(\left(\frac{-1}{5}\cdot\pi\right)\right)} = \frac{-\left(\sqrt{5}-1\right)\sqrt{-2\cdot\left(\sqrt{5}-5\right)}}{4}$$

1.78
1.79
1.80
1.81

1.82 a $$\frac{¶}{¶x}\left(\tan(2\cdot x)\right) = \frac{2}{\left(\cos(2\cdot x)\right)^2}$$

b $$\frac{¶}{¶x}\left(\tan(x)\right)® = \frac{2\cdot\sin(x)}{\left(\cos(x)\right)^3}$$

c $$\frac{¶}{¶x}\frac{1}{\tan(x)} = \frac{-1}{\left(\sin(x)\right)^2}$$

1.83

1.8.2 a $\frac{\P}{\P x}(\tan(x)) = \frac{1}{(\cos(x))^{2}}$

1.84 $L = L_0 \cdot (1 + 2 \cdot 10^{-5} \cdot t + 3.5 \cdot 10^{-8} \cdot t®)$

$$U = \frac{\frac{\P}{\P t}\left(L_0 \cdot (1 + 2 \cdot 10^{-5} \cdot t + 3.5 \cdot 10^{-8} \cdot t®)\right)}{L_0} \qquad u = 7.e\text{-}8 \cdot (t + 285.714)$$

$ans \mid t = 50 \qquad u = .000023$

1.85 b

$$R = q\cdot\left(500 + \left(\frac{1}{6}\right)\cdot q - \left(\frac{1}{3600}\right)\cdot q^2\right)$$

$$\frac{\partial}{\partial q}\left(q\cdot\left(500 + \left(\frac{1}{6}\right)\cdot q - \left(\frac{1}{3600}\right)\cdot q^2\right)\right) \qquad = \frac{-\left(q^2\right)}{1200} + \frac{q}{3} + 500$$

$$\text{solve}(ans = 0, q) \qquad = q = 1000 \text{ or } q = -600$$

$$R = q\cdot\left(500 + \left(\frac{1}{6}\right)\cdot q - \left(\frac{1}{3600}\right)\cdot q^2\right) \mid q = 1000 \qquad r = \frac{3500000}{9}$$

$$\text{approx}(ans) \qquad r = 388889.$$

1.86 b

$$AB = \sqrt{(125 - 20\cdot t)^2 + (15\cdot t)^2} \qquad ab = 25\cdot\sqrt{t^2 - 8\cdot t + 25}$$

c

$$\frac{\partial}{\partial t}\left(25\cdot\sqrt{t^2 - 8\cdot t + 25}\right) \qquad = \frac{25\cdot(t - 4)}{\sqrt{t^2 - 8\cdot t + 25}}$$

$\text{solve}(ans = 0, t) \qquad t = 4$ --> 04.00u

1.87 b

$$\text{solve}\left(0 = \left(3 - \left(\frac{1}{2}\right)\cdot t\right)^2, t\right) \qquad t = 6$$

$$s(t) = 18 - \left(\frac{2}{3}\right)\cdot\left(3 - \left(\frac{1}{2}\right)\cdot t\right)^3 \mid t = 6 \qquad s(6) = 18$$

1.88 a

$$O = 2\cdot x + 2\cdot\left(\frac{12}{x}\right) \qquad o = 2\cdot x + \frac{24}{x}$$

b

$$\frac{\partial}{\partial x}\left(2\cdot x + \frac{24}{x}\right) \qquad = 2 - \frac{24}{x^2}$$

$$\text{solve}(ans = 0, x) \qquad x = 2\cdot\sqrt{3} \text{ or } x = -2\cdot\sqrt{3}$$

1.89 a

$$V_A = \frac{\partial}{\partial t} t^2 \qquad = 2\cdot t$$

$$V_B = \frac{\partial}{\partial t}\left(t^3 - 3\cdot t^2 + 4\cdot t\right) \qquad = 3\cdot t^2 - 6\cdot t + 4$$

b

$$\text{solve}\left(t^2 = 3\cdot t^2 - 6\cdot t + 4, t\right) \qquad t = 2 \text{ or } t = 1$$

c

d

e

$$\frac{\partial}{\partial t}\left(3\cdot t^2 - 6\cdot t + 4\right) \qquad = 6\cdot t - 6$$

$$\text{solve}(6\cdot t - 6 = 0, t) \qquad t = 1$$

1.90 a

$a \cdot t^3 + b \cdot t^2 + c \cdot t + d = 0 \mid t = 0 \qquad d = 0$

$\frac{\partial}{\partial t}\left(a \cdot t^3 + b \cdot t^2 + c \cdot t\right) \qquad = 3 \cdot a \cdot t^2 + 2 \cdot b \cdot t + c$

$3 \cdot a \cdot t^2 + 2 \cdot b \cdot t + c \mid t = 0 \qquad = c$ --> c = 0

$3 \cdot a \cdot t^2 + 2 \cdot b \cdot t \mid t = 4 \qquad = 48 \cdot a + 8 \cdot b$

$\text{solve}(48 \cdot a + 8 \cdot b = 0, b) \qquad b = -6 \cdot a$

$a \cdot t^3 + b \cdot t^2 = 10 \mid t = 4 \qquad 64 \cdot a + 16 \cdot b = 10$

$64 \cdot a + 16 \cdot b = 10 \mid b = -6 \cdot a \qquad -32 \cdot a = 10$

$\text{solve}(-32 \cdot a = 10, a) \qquad a = \frac{-5}{16}$

$b = -6 \cdot a \mid a = \frac{-5}{16} \qquad b = \frac{15}{8}$

1.91 a

$\left(2 \cdot 10^{-9}\right)^3 \qquad = \frac{1}{125000000000000000000000000}$

1.92 a

$\text{solve}\left(\frac{1}{b} + \frac{1}{v} = \frac{1}{f}, b\right) \qquad b = \frac{f \cdot v}{v - f}$

$b = \frac{f \cdot v}{v - f} \mid f = 25 \qquad b = \frac{25 \cdot v}{v - 25}$

$\frac{\partial}{\partial v}\frac{25 \cdot v}{v - 25} \qquad = \frac{-625}{(v - 25)^2}$

$b = \frac{25 \cdot v}{v - 25} \mid v = \frac{t^2}{t + 1} \qquad b = \frac{25 \cdot t^2}{t^2 - 25 \cdot t - 25}$

$\frac{\partial}{\partial t}\frac{25 \cdot t^2}{t^2 - 25 \cdot t - 25} \qquad = \frac{-625 \cdot t \cdot (t + 2)}{\left(t^2 - 25 \cdot t - 25\right)^2}$

1.93 a

$\frac{\partial}{\partial t}\left(5000 + 2 \cdot t \cdot (1 - t)^4\right) \qquad = 10 \cdot t^4 - 32 \cdot t^3 + 36 \cdot t^2 - 16 \cdot t + 2$

$10 \cdot t^4 - 32 \cdot t^3 + 36 \cdot t^2 - 16 \cdot t + 2 \mid t = 2 \qquad = 18$

$\text{solve}\left(10 \cdot t^4 - 32 \cdot t^3 + 36 \cdot t^2 - 16 \cdot t + 2 = 0, t\right) \qquad t = 1 \text{ or } t = \frac{1}{5}$

1.94