1.1 $\frac{2^{17}}{2^{3}\cdot 2^{5}} = \frac{2^{17}}{2^{8}} = \boxed{2^{9}}$

1.2
$6^{2}\cdot 6^{x} = 6^{6}$

$6^{x+2} = 6^{6} \quad / \log 6$

$x+2 = 6$

$\boxed{x = 4}$

1.3 $xy = 5 \qquad x^{3}y^{3} = ?$

$xy \cdot xy \cdot xy = x^{3}y^{3} = 5\cdot 5\cdot 5 = 125$

1.4. $\frac{\sqrt{2^{10}}}{\sqrt{4^{3}}} = \frac{\sqrt{2^{10}}}{\sqrt{2^{6}}} = \sqrt{\frac{2^{\cancel{10}\,4}}{\cancel{2^{6}}}} = \sqrt{2^{\cancel{4}\,2}} = \boxed{4}$

1.5.1 $x+y = y+x$

2 $x(y+z) = xy + xz$

3 $x^{y+z} = x^{y} + x^{z}$

4 $\frac{x^{y}}{x^{z}} = x^{y-z}$

1. TRUE ✓
2. TRUE ✓
3. FALSE
4. TRUE ✓

1.6. $\frac{2x-5}{2} \geq 4$

$2x - 5 \geq 8$

$2x \geq 13$

$\boxed{x \geq 6{,}5}$

2.1. $0°C = 32°F$

$100°C = 212°F$

$f(x_1) = x$

$f(x_2) = 32 + \frac{180}{100}x$

$f(x_1) = f(x_2)$

$x = 32 + \frac{180}{100}x$

$-0{,}8x = 32$

$\boxed{x = -40}$

-40°F is the temprature when the Celcius scale is showing the same number (-40°C)

2.2 $f(x) = 5x+4$ $f(y) = 24$

$\boxed{x = 4}$

2.3. $10^{x^2-2x+2} \; (=100) = 10^2$ $/ \log_{10}$

$x^2 - 2x + 2 = 2$

$x(x-2) = 0$ → $\boxed{x_1 = 0 \quad x_2 = 2}$

2.4. $\cancel{x} \cdot 1{,}03^y = 2\cancel{x}$

$1{,}03^y = 2$ $/ \ln$

$y = \frac{\ln 2}{\ln 1{,}03}$ $\boxed{y = 23{,}4498}$

2.5 $\ln\frac{1}{e} = \ln(e^{-1}) = -\ln e = \boxed{-1}$

$\ln e = 1$

3.1 $\sum_{i=0}^{\infty}\left(\frac{1}{8^i} + \frac{1}{2^i}\right) = \sum_{i=0}^{\infty} \frac{1}{8^i} + \sum_{i=0}^{\infty} \frac{1}{2^i}$ $\frac{1}{8^i} = r_1$, $\frac{1}{2^i} = r_2$

$= \frac{1}{1-r_1} + \frac{1}{1-r_2} = \frac{1}{1-\frac{1}{8}} + \frac{1}{1-\frac{1}{2}} = \frac{8}{7} + 2 = \boxed{\frac{22}{7}}$

$\frac{7}{8}$ $\frac{1}{2}$

3.2 $\lim_{x \to 3} \frac{x-3}{2}$ $p(x) = \frac{x-3}{2}$

$\lim_{x \to 3} p(x) = \lim\left(\frac{x-3}{2}\right) = \frac{3-3}{2} = \frac{0}{2} = \boxed{0}$

$p(0)$

3.3 $f(x) = x^2 - 4$ $(\underset{x}{-1}, \underset{y}{-3})$

$m = 2x = f'(x)$

$\boxed{f'(-1) = -2}$

3.4. $\frac{d}{dx}\frac{x^2+3}{x+2}$

$(uv)' = u'v + uv'$

$\left(u\cdot\frac{1}{v}\right)' = u'\left(\frac{1}{v}\right) + u\cdot\left(\frac{1}{v}\right)\cdot\left(\frac{u}{v}\right)' =$

$= \frac{u'v - uv'}{v^2}$

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

$= \frac{\cancel{2}x^2+4x-\cancel{x^2}-3}{(x+2)^2} = \boxed{\frac{x^2+4x-3}{(x+2)^2}}$

3.5.

$\frac{d^2}{dx^2} = 4x^3+4$

$f'(x) = 12x^2$

$\boxed{f''(x) = 24x}$

3.6 $f(x) = 1/x$ coutinious at 0? WHY?

NOT coutinious because even though $\lim_{x\to 0^+} 1/x = \lim_{x\to 0^-} 1/x = 0$ but $f(0)$ is not defined.

3.7 $f(x) = 3x^3 - 9x$

$f'(x) = 9x^2 - 9$

$f''(x) = 18x$

crit point : set $f'(x) = 0$

$0 = 9(x+1)(x-1)$

$x = \pm 1$

$f''(x) = 0 \Leftrightarrow x = 0$

x	$-\infty,1$	-1	$-1;0$	0	$0,1$	1	$1;\infty$
$f(x)$	↗	loc max $(-1;6)$	↘	infl. point	↘	loc $(1;-6)$ min.	↗
$f'(x)$	+	0	−	−	−	0	+
$f''(x)$	−	−	−	0	+	+	+

NOTEBOOK

3.8. $f(x,y) = x^2y^3 \quad f(2;3)$

$= 4 \cdot 27 = \boxed{108}$

3.9 $f(x,y) = \ln(x-y)$

$\ln(z)$ is defined for $z>0$

we need $x-y>0$

$x>y$

3.10 $\frac{\partial^2}{\partial x^2} x^5+xy^3$

2 possibilities

1. $\frac{\partial^2}{\partial x^2}(x^5+xy^3) = \frac{\partial}{\partial x} 5x^4+y^3 = 20x^3$

2. $\frac{\partial^2}{\partial x^2}(x^5)+xy^3 = 20x^3+xy^3$

3.11 $f(x,y) = \sqrt{xy} - 0{,}5x - 0{,}5y$

$f(x) = \frac{1}{2}(xy)^{-\frac{1}{2}}y - 0{,}5$

$f(y) = \frac{1}{2}(xy)^{-\frac{1}{2}}x - 0{,}5$

$f(xy) = \frac{1}{2\sqrt{xy}} - \frac{xy}{4(xy)^{3/2}}$

$0 = \frac{1}{2}(xy)^{-\frac{1}{2}}y - \frac{1}{2}$

Hessian determinant

$$\begin{bmatrix} -\frac{y^2}{4(xy)^{3/2}} & \frac{1}{2\sqrt{xy}} - \frac{xy}{4(xy)^{3/2}} \\ \frac{1}{2\sqrt{xy}} - \frac{xy}{4(xy)^{3/2}} & -\frac{x^2}{4(xy)^{3/2}} \end{bmatrix}$$

$1 = (xy)^{-\frac{1}{2}}y$

$1 = \frac{y}{\sqrt{xy}} = \sqrt{\frac{y^{\cancel{2}}}{xy}} = \sqrt{\frac{y}{x}} \quad x=y$

3.12 $\max x^2y^2 = f(x,y)$ $x+y=5 = g(x,y)$

$\nabla f(x,y) = (2xy^2, 2x^2y)$

$\nabla g(x,y) = (1,1)$

Solve

$(2xy^2, 2x^2y) = \lambda(1,1)$

$x+y=5$

$$\left.\begin{aligned} 2x^2y &= \lambda \\ 2xy^2 &= \lambda \\ x+y &= 5 \end{aligned}\right\}$$

$\cancel{2}x\cancel{x}\cancel{y} = \cancel{2}\cancel{y}y\cancel{x}$

$x=y$

$x+x=y+y=5$

$\boxed{x=y=2,5}$

4.1 $B = \begin{bmatrix} 1 & 4 & 1 \\ 2 & 1 & 2 \end{bmatrix}$

$A = \begin{bmatrix} 2 & 3 \\ 4 & 1 \\ 1 & 2 \end{bmatrix}$ $\begin{matrix} 8 & 11 & 8 \\ 6 & 17 & 6 \\ 5 & 6 & 5 \end{matrix}$

$AB = \begin{bmatrix} 8 & 11 & 8 \\ 6 & 17 & 6 \\ 5 & 6 & 5 \end{bmatrix}$

4.2 $A = \begin{bmatrix} 2 & 3 \\ 4 & 1 \\ 1 & 2 \end{bmatrix}$

$B = \begin{bmatrix} 1 & 4 & 1 \\ 2 & 1 & 2 \end{bmatrix} \begin{bmatrix} 19 & 9 \\ 10 & 11 \end{bmatrix}$

$B \cdot A = \begin{bmatrix} 19 & 9 \\ 10 & 11 \end{bmatrix}$

4.3 $A = \begin{bmatrix} 3,3 & 5,1 & 4,7 \\ 2 & 6,1 & 1,23 \\ 4 & 5,76 & 0 \end{bmatrix}$ $A^T = \begin{bmatrix} 3,3 & 2 & 4 \\ 5,1 & 6,1 & 5,76 \\ 4,7 & 1,23 & 0 \end{bmatrix}$

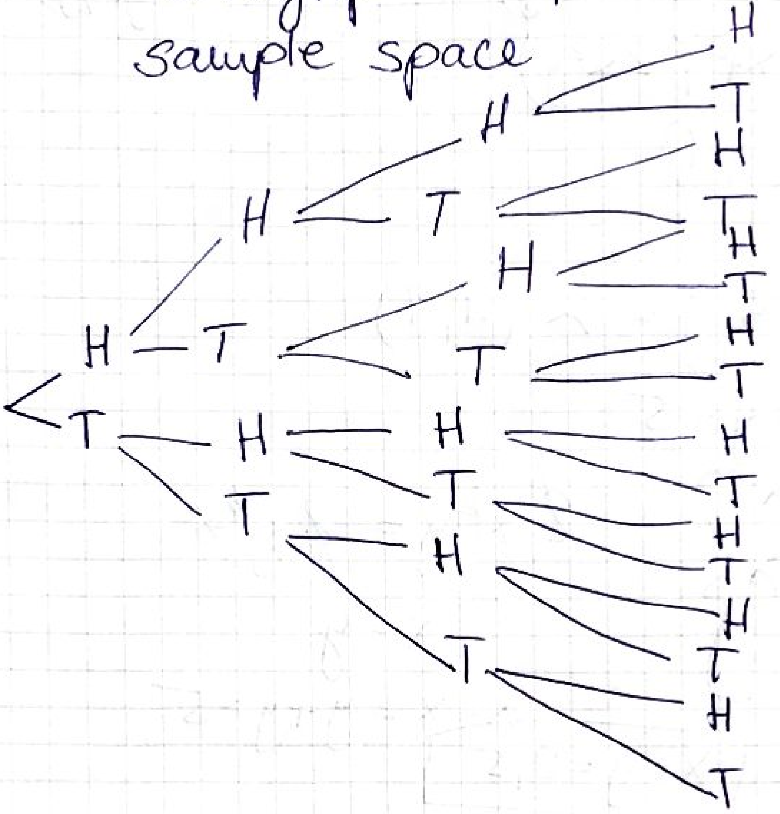
4.4 $A = \begin{array}{c} \begin{matrix} a & b \end{matrix} \\ \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \\ \begin{matrix} c & d \end{matrix} \end{array}$ $\det A = ad - bc$

$= 2 \cdot 5 - 3 \cdot 4 = \boxed{-2}$

NOTE BOOK

5.1 Coin flip H, T

sample space



HHHH
HHHT
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THTT
TTHH
TTHT
TTTH
TTTT

$\boxed{16}$

5.2 1 % drug   A = drug user

99% + drug | +

99% - | -

Bayes

~~P(A)~~ $P[A] = 0{,}01$

$P[+|A] = {,}99$

$P[-|\bar{A}] = 0{,}995$

$P[+|\bar{A}] = 0{,}99$

$$P[A|+] = \frac{P[+|A]\cdot P[A]}{P[+]}$$

$$= \frac{P[+|A]\cdot P[A]}{P[+|A]\cdot P[A] + P[+|\bar{A}]\cdot P[\bar{A}]}$$

$$= \frac{\cancel{0{,}99}\cdot 0{,}01}{\cancel{0{,}99}\cdot 0{,}01 + 0{,}99\cdot \cancel{0{,}99}} = \frac{0{,}01}{1} =$$

$$\boxed{= 0{,}01 \mathrel{\widehat{=}} 1\%}$$

5.3 Dice 2x

$E = \frac{21}{6}$

$E(x+y) = E(x) + E(y)$ because events are independent and $E(\text{one roll}) = \frac{1+2+3+4+5+6}{6} = 3{,}5$

$E(2\text{ roll}) = 2 \times 3{,}5 = \underline{\underline{7}}$