Answers to LaTeX Exercises

Exercise 1

opy this file to your directory and look up how to process it in the local guide. Note how the input
tex file contains quite verbose instructions in plain text, which are the typesetting commands.
Use the Local Guide!]

Exercise 2

utliers are sample values which cause surprise in relation to the majority of the sample. This is
ot a pejorative term; outliers may be correct, but they should always be checked for transcription
rrors.

he sample mean can be upset completely by a single outlier; if any data value go to infinity, then so
oes the mean. This contrasts with the sample median, which is little affected by moving any single
alue to infinity. We say that the median is *resistant* to *gross errors* whereas the mean is not. In fact
he median will tolerate up to 50% gross errors before is can be made arbitrarily large; we say its
reakdown point is 50% whereas that for the mean is 0%.

```
documentclass[12pt, a4paper]{article}
usepackage{parskip,times}

oegin{document}

textbf {Outliers} are sample values which cause surprise in
elation to the majority of the sample. This is not a pejorative
erm; outliers may be correct, but they should always be checked
or transcription errors.

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ill tolerate up to 50\% gross errors before is can be made
rbitrarily large; we say its \emph {breakdown point} is 50\%
hereas that for the mean is 0\%.
end{document}
```

Exercise 3

I entered the room and—horrors—I saw both my father-in-law and my mother-in-law.

The winter of 1484–1485 was one of discontent.

Frank wondered, “Is this a girl that can’t say ‘No!’?”

```
\begin{quote}
I entered the room and---horrors---I saw both my father-in-law
and my mother-in-law.

The winter of 1484--1485 was one of discontent.

Frank wondered, ``Is this a girl that can't say `No!'?''
\end{quote}
```

Exercise 4

Refine the exercise 2, and try changing the type face of words and the type size of paragraphs.

Exercise 5

Does Æschylus understand Œdipus?

The smallest internal unit of TEX is about 53.63Å.

They took some honey and plenty of money wrapped up in a £5 note.

Élèves, refusez vos leçons! Jetez vos chaînes!

Can you take a ferry from Öland to Åland.

```
Does \AE schylus understand \OE dipus?

The smallest internal unit of \TeX{} is about 53.63\AA.

They took some honey and plenty of money wrapped up in a \pounds 5 note.

\'El\`eves, refusez vos le\c cons! Jetez vos cha\^\i nes!

Can you take a ferry from \"Oland to \AA land.
```

Exercise 6

Currencies 1 Jan 1992

London:	New York:
£: $ 1.8672	£: $ 1.8655
£: DM 2.8369	$: DM 1.5175
£: FFr 9.969080	$: FFr 5.1845

```
egin{center}
medskip
\Large \bfseries Currencies 1 Jan 1992}\\
igskip
egin{tabular}{ll}
sffamily \large London: & \sffamily\large New York:\\ \hline \hline
pounds : \$ 1.8672 &\pounds : \$ 1.8655 \\
pounds : DM 2.8369 &\$: DM 1.5175\\
pounds : FFr 9.969080 &\$: FFr 5.1845
nd{tabular}
nd{center}
```

xercise 7

xperiment with exercise 2 in different classes and styles (11pt, article, report, book, letter).

xercise 8

ive exercise 2 a title, and some sections, and experiment further with the different styles.

xercise 9

rom: Susan Hutchinson (University of Oxford)
ate: 27 May 2003

A trial memo

m just testing the memo command . . . testing . . . testing . . . testing . . . testing . . . testing . . . testing
. testing . . . testing . . . testing

his is typset as follows:

```
newcommand{\auth}{Susan Hutchinson}
newcommand{\OU}{{\sf University of Oxford}}

renewcommand{\today}{\number\day\space \ifcase\month\or
 January\or February\or March\or April\or May\or June\or
 July\or August\or September\or October\or November\or December\fi
  \space\number\year}

newcommand{\memo}[1]{{\large From:} \auth \qquad(\OU)\\
\large Date:} \today\\
medskip\hrule\bigskip \centerline{\Large #1}\bigskip}
```



```
\memo{A trial memo}
I'm just testing the memo command \ldots testing \ldots
testing \ldots testing \ldots testing \ldots testing \ldots
testing \ldots testing \ldots testing \ldots testing
```

Exercise 10

$C(n,r) = n!/(r!\,(n-r)!)$.

```
$C(n,r)=n!/(r!\,(n-r)!).$
```

Exercise 11

This equation is in-line $a+b=c-d=xy=w/z$ and the following one is displayed.

$$a+b=c-d=xy=w/z$$

```
This equation is in-line $a+b=c-d=xy=w/z$ and the following
one is displayed. $$a+b=c-d=xy=w/z$$
```

Exercise 12

An in-line example: $(fg)' = f'g + fg'$ followed by one that is displayed:

$$(fg)' = f'g + fg'$$

```
An in-line example: $(fg)' = f'g + fg'$ followed by one
that is displayed: $$(fg)' = f'g + fg'$$
```

Exercise 13

In-line the equation is $\alpha\beta =\gamma+\delta$ and displayed

$$\alpha\beta =\gamma+\delta$$

```
In-line the equation is $\alpha\beta =\gamma+\delta$ and displayed
$$\alpha \beta = \gamma + \delta$$
```

Exercise 14

In-line the equation is $\Gamma(n) = (n-1)!$ and displayed

$$\Gamma(n) = (n-1)!$$

```
In-line the equation is $\Gamma (n) = (n-1)!$ and displayed
 $$\Gamma (n) = (n-1)!$$
```

xercise 15

$\wedge (y \vee z) = (x \wedge y) \vee (x \wedge z)$.

```
x\wedge (y\vee z) = (x\wedge y) \vee (x\wedge z)$.
```

xercise 16

$+ 4 + 6 + \cdots + 2n = n(n+1)$.

```
2 + 4 + 6 + \cdots + 2n = n(n+1).$
```

xercise 17

$\cdot \vec{y} = 0$ if and only if $\vec{x} \perp \vec{y}$.

```
\vec x\cdot \vec y = 0$ if and only if $\vec x \perp \vec y$.
```

xercise 18

$\cdot \vec{y} \neq 0$ if and only if $\vec{x} \not\perp \vec{y}$.

```
\vec x\cdot \vec y \not= 0$ if and only if $\vec x \not\perp \vec y.$
```

r use $\vec{x} \cdot \vec{y} \neq 0$ which is `$\vec x\cdot \vec y \ne 0$`

xercise 19

$\forall x \in \mathbb{R})(\exists y \in \mathbb{R})$ such that $y > x$.

```
(\forall x \in \mathbb{R}) (\exists y \in \mathbb{R})$ such that $y>x.$
```

ote that amssymb must be included in the usepackage declaration at the beginning of the file in rder to use `\mathbb{R}`.

xercise 20

$\frac{a+b}{c} \quad \frac{a}{b+c} \quad \frac{1}{a+b+c} \neq \frac{1}{a} + \frac{1}{b} + \frac{1}{c}$.

```
\frac{a+b}{c}\quad \frac{a}{b+c}\quad \frac{1}{a+b+c} \not=
frac{1}{a}+\frac{1}{b}+\frac{1}{c}.$
```

ne could be used instead of `\not=`

Exercise 21

What are the points where $\frac{\partial}{\partial x} f(x,y) = \frac{\partial}{\partial y} f(x,y) = 0$?

```
What are the points where $\frac{\partial}{\partial x}f(x,y)=\frac
{\partial}{\partial y}f(x,y)=0$?
```

Exercise 22

$e^x \quad e^{-x} \quad e^{i\pi}+1=0 \quad x_0 \quad x_0^2 \quad {x_0}^2 \quad 2^{x^x}$.

```
$e^x \quad  e^{-x}  \quad e^{i\pi}+1=0 \quad x_0 \quad  x^2_0
\quad  {x_0}^2\quad  2^{x^x}$.
```

Exercise 23

$\nabla^2 f(x,y) = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$.

```
$\nabla^2 f(x,y) = \frac{\partial^2 f}{\partial x^2}
+ \frac{\partial^2 f}{\partial y^2}$.
```

Exercise 24

$\lim_{x\to 0} (1+x)^{\frac{1}{x}} = e$.

```
$\lim_{x\to 0} (1+x)^{\frac{1}{x}}=e$.
```

Exercise 25

The cardinality of $(-\infty, \infty)$ is $\aleph_1$.

```
The cardinality of $(-\infty ,\infty)$ is $\aleph_1$.
```

Exercise 26

$\lim_{x\to 0^+} x^x = 1$.

```
$\lim_{x\to {0^+}} x^x = 1$.
```

Exercise 27

$\int_0^1 3x^2 \, \mathrm{d}x = 1$.

```
$\int_0^1 \,3x^2\,\mathrm{d}x=1$.
```

Exercise 28

$\sqrt{2} \quad \sqrt{\frac{x+y}{x-y}} \quad \sqrt[3]{10} \quad e^{\sqrt{x}}$.

```
\sqrt2 \quad \sqrt \frac{x+y}{x-y} \quad \root 3 \of {10}$
quad $e^{\sqrt x}$.
```

Exercise 29

$\|x\| = \sqrt{x \cdot x}$.

```
\|x\| = \sqrt{x\cdot x}$.
```

Exercise 30

$\phi(t) = \frac{1}{\sqrt{2\pi}} \int_0^t e^{-x^2/2}\,\mathrm{d}x$.

```
\phi(t) = \frac{1}{\sqrt{2_\pi}} \int_0^t \, e^{-x^{2}/2},\mathrm{d}x$.
```

Exercise 31

$\underline{x} \quad \overline{y} \quad \underline{\overline{x+y}}$.

```
\underline x \quad \overline y \quad \underline{\overline{x+y}}$.
```

Exercise 32

$\bigl\lceil \lfloor x \rfloor \bigr\rceil \leq \bigl\lfloor \lceil x \rceil \bigr\rfloor$.

```
\bigl \lceil \lfloor x\rfloor  \bigr \rceil
  \leq \bigl \lfloor \lceil x\rceil \bigr \rfloor$.
```

Exercise 33

$\sin(2\theta) = 2\sin\theta\cos\theta \quad \cos(2\theta) = 2\cos^2\theta - 1$.

```
\sin(2\theta ) = 2 \sin\theta\cos\theta \quad \cos(2\theta)
= 2\cos^2\theta - 1$.
```

Exercise 34

$$\int \csc^2 x\,\mathrm{d}x = -\cot x + C \qquad \lim_{\alpha\to 0} \frac{\sin\alpha}{\alpha} = 1 \qquad \lim_{\alpha\to\infty} \frac{\sin\alpha}{\alpha} = 0.$$


```
$$\int \csc^2x\,  \mathrm{d}x = -\cot x + C
\qquad \lim_{\alpha\to 0} \frac{\sin\alpha}{\alpha} = 1
\qquad \lim_{\alpha \to \infty} \frac{\sin\alpha}{\alpha} = 0.$$
```

Exercise 35

$$\tan(2\theta) = \frac{2\tan\theta}{1-\tan^2\theta}.$$

```
$$\tan (2\theta) = \frac{2\tan\theta}{1-\tan^2\theta}.$$
```

Exercise 36

$$\begin{bmatrix} aa & \cdots & az \\ \vdots & \ddots & \vdots \\ za & \cdots & zz \end{bmatrix}$$

```
$$\left[
\begin{array}{ccc}
aa & \cdots & az \\
\vdots & \ddots & \vdots \\
za & \cdots & zz
\end{array}
\right]$$
```

Exercise 37

A random variable Y has density

$$f(y;\theta,\phi) = \exp\left\{\frac{y\theta - b(\theta)}{a\phi} + c(y;\phi)\right\}$$

and its moment-generating function is $M(t) = \exp[\{b(\theta + ta\phi) - b(\theta)\}/(a\phi)]$.

```
A random variable $Y$ has density
$$f(y;\theta,\phi) = \exp\left\{ \frac{y\theta-b(\theta)}
{a\phi} + c(y;\phi)\right\}$$
and its moment-generating function is $M(t)
 $M(t) = \exp[ \{b(\theta+ta\phi) - b(\theta)\}/(a\phi)]$.
```

Exercise 38

If $Y_{rc}, r = 1,\ldots,R, c = 1,\ldots,C$ are random variables, show that

$$\sum_{r,c}(Y_{rc} - \overline{Y}_{..})^2 = \sum_{r,c}(\overline{Y}_{r.} - \overline{Y}_{..})^2 + \sum_{r,c}(\overline{Y}_{.c} - \overline{Y}_{..})^2 + \sum_{r,c}(Y_{rc} - \overline{Y}_{.c} - \overline{e}Y_{..})^2. \qquad (1)$$

```
f $Y_{rc}$, $r=1,\ldots, R$, $c=1,\ldots, C$ are random variables,
now that
begin{equation}
label{linear.models.equation.1}
sum_{r,c} (Y_{rc}-\overline Y_{..})^2
 \sum_{r,c} (\overline Y_{r.}-\overline Y _{..})^2 + \sum_{r,c}
\overline Y_{.c}-\overline Y_{..})^2 + \sum_{r,c} (Y_{rc}
 \overline Y_{.c} - \overline e Y_{..})^2.
end{equation}
```

Exercise 39

$$f(x_i \,|\, \lambda_i) = \lambda_i e^{-\lambda_i x_i}, \qquad f(y_i \,|\, \lambda_i, \psi) = \lambda_i \psi e^{-\lambda_i \psi y_i}, \qquad x_i, y_i \geq 0.$$

```
$f(x_i\,|\,\lambda_i) = \lambda_i e^{-\lambda_i x_i}, \qquad
(y_i\,|\,\lambda_i, \psi) = \lambda_i\psi e^{-\lambda_i\psi y_i},
qquad x_i, y_i \ge 0.$$
```

ou could use `\mid`, but the spacing would be larger.

Exercise 40

$$\frac{\partial G}{\partial t} = \lambda s(s-1)\frac{\partial G}{\partial s}.$$

```
$\frac{\partial G}{\partial t} = \lambda s(s-1)
frac{\partial G}{\partial s}.$$
```

Exercise 41

1. Generate independent uniforms U and U_1.
2. Set $\begin{cases} X = 1/(4U-1), V = U_1/X^2 & \text{if } U < 0.5, \\ X = 4U-3, V = U_1 & \text{otherwise.} \end{cases}$
3. If $V < 1 - 0.5|X|$ go to 5.
4. If $V \geq (1 + X^2/\nu)^{-(\nu+1)/2}$ go to 1.
5. Return X.

```
begin{enumerate}
item Generate independent uniforms $U$ and $U_1$.
item $
mbox{Set } \begin{cases}
 = 1/(4U - 1), V = U_1/X^2& \mbox{if $U < 0.5$,}\\
 = 4U - 3, V = U_1 & \mbox{otherwise}.
end{cases}
```



```
$
item If $V < 1 - 0.5|X|$ go to 5.
item If $ V \ge (1 + X^2/\nu)^{-(\nu+1)/2}$ go to 1.
item Return $X$.
end{enumerate}
```

The amsmaths cases environment was used here.

Exercise 42

$$h_i(t) = \lim_{\epsilon \to 0} \frac{1}{\epsilon} \frac{\mathsf{P}(t < T_i \leqslant t + \epsilon)}{\mathsf{P}(T_i > t)}.$$

```
renewcommand{\Pr}{\mathsf{P}}
$$h_i(t)=\lim_{\epsilon\to 0} \frac{1}{\epsilon}
frac{\Pr(t<T_i\leqslant t+\epsilon)}{\Pr(T_i>t)}.$$
```