INFORMATICS 1 – 1ST MIDTERM

You have 45 minutes to finish your midterm. When done, send the `.tex` file to `sa42bme@gmail.com`.

1. LaTeX

(1) One can't just write the character { in a text without taking some precautions, because it has a *special* meaning.

```
One can't just write the character \{  in a text
without taking some precautions, because it has
a \emph{special} meaning.
```

special characters, `\em` or `\emph`

(2) Everyone knows that $\left(\frac{1}{6}x - \frac{1}{12}\sin 2x\right)' = \frac{1}{3}\sin^2 x$

```
Everyone knows that
$\left(\frac16x - \frac1{12}\sin2x\right)'
= \frac13\sin^2x$
```

inline math, `frac`, `left/right`, `\sin`, superscripts

(3)

$$(a_0 + a_1x + \cdots + a_nx^n) + (b_0 + b_1x + \cdots + b_nx^n) \\ = (a_0 + b_0) + (a_1 + b_1)x + \cdots + (a_n + b_n)x^n$$

```
\begin{multline*}
  (a_0+a_1x+\dots+a_nx^n)+(b_0+b_1x+\dots+b_nx^n)
  \\ = (a_0+b_0)+(a_1+b_1)x+\dots+(a_n+b_n)x^n
\end{multline*}
```

`multline*`, `\dots`

Date: October 25, 2022.

(4) Let

$$f_n(x) = \begin{cases} x^n \sin(1/x) & \text{if } x \neq 0 \\ 0 & \text{otherwise.} \end{cases}$$

```
Let \[f_n(x) =
  \begin{cases} x^n\sin(1/x)
    &\text{if $x\neq0$}
    \\0&\text{otherwise.}
  \end{cases}
  \]
```

`cases`, alignment, `\text`, `\sin`

(5)

$$f(x,y) = e^x \sin y \qquad g(x,y) = e^x \cos y$$
$$f_y(x,y) = g(x,y) \qquad g_y(x,y) = -f(x,y)$$

```
\begin{align*}
  f(x,y)&=e^x\sin y &g(x,y)&=e^x\cos y\\
  f_y(x,y)&=g(x,y) &  g_y(x,y) &= -f(x,y)
\end{align*}
```

math functions (`\sin` and `\cos`), `align*`

(6)

Theorem 1.1. *If f is integrable on the interval $[a,b]$, $\varphi : [c,d] \to [a,b]$ is a differentiable strictly monotone bijection, then*

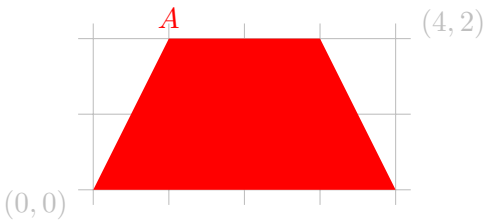
$$\int_a^b f(x)\,dx = \int_{\varphi^{-1}(a)}^{\varphi^{-1}(b)} f(\varphi(t))\varphi'(t)\,dt.$$

```
If $f$ is integrable on the interval $[a,b]$,
$\varphi:[c,d]\to[a,b]$ is a differentiable
strictly monotone bijection, then
\[\int_a^b f(x)\,dx =
\int_{\varphi^{-1}(a)}^{\varphi^{-1}(b)}
f(\varphi(t))\varphi'(t)\;dt.\]
```

`theorem` env, displayed formula, integral (incl. "thin horizontal space" before dx), limits

2. TikZ

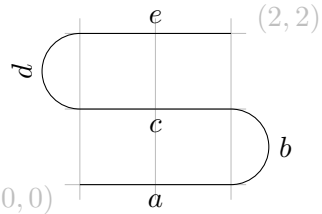
You don't need to draw the gray stuff (grids and coordinates).



(1)

```
\fill[red] (0,0) -- (4,0) -- (3,2) --
(1,2) node[above] {$A$} --  cycle ;
```

`draw[fill]` or `fill`, `cycle`,`node`



(2)

```
\draw (0,0) -- (2,0) node[midway, below] {$a$}
arc (-90:90:0.5) node[midway, right] {$b$}
-- (0, 1) node[midway, below] {$c$} arc
(270:90:0.5) node[midway, above,sloped] {$d$}
-- (2,2) node[midway, above] {$e$};
```

`arc` with the right signs, `node`, `node[sloped]`