# Homework Template and Samples

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October $12^{th}$ 1979

**Abstract**

This document introduces a standard template box for typing up homework. This can help make homework look better and be easier to read. The suggested template box also automatically leaves a space for an instructor to leave comments and insert a grade.

## 1 The Template

Here is a blank Template Box:

| **Title Goes Here** | **Grade:** |
|---|---|
| Answer Goes Here!!! | ***Faculty Comments*** |

The code for this in the LaTeX document looks like this:

```
\begin{problem}{Title Goes Here}
    Answer Goes Here!!!
\end{problem}
```

Whenever you want to type up a new problem you insert the above code, change the title to give the page and problem number, and type the solution in between the begin and end tags (where it says answer goes here). This way multiple questions might look like this:

| **p.xyz # 23** | **Grade:** |
|---|---|
| Answer Goes Here!!! | ***Faculty Comments*** |

| **p.yzx # 32** | **Grade:** |
|---|---|
| Answer Goes Here!!! | ***Faculty Comments*** |

| **p.zxy # 5** | **Grade:** |
|---|---|
| Answer Goes Here!!! | ***Faculty Comments*** |

And since they are all typed up it is easier to rearrange them or edit them.
In the following section there are a set of increasingly intricate examples of problems including the necessary code to type them up. You can of course also look at the raw code.

# 2 Sample Problems

| **p.42 # 1952: Some Equations** | **Grade:** |
|---|---|
| In this exercise we demonstrate an inline expression like $f(x) = x^2 - 4x = 4$, which is typeset like so `\(f(x)=x^2-4x=4\)` and in solving $f(x) = 0$ we can demonstrate a displayed equation as well:<br>$$f(x) = 0 \Rightarrow x^2 - 4x + 4 = (x-2)^2 = 0 \Rightarrow x = 2,$$<br>which is typed like so:<br>`\[f(x)=0\Rightarrow x^2-4x+4=(x-2)^2=0 \Rightarrow x=2,\]`<br>Or, better yet with a stacked equation:<br>$$\begin{aligned} f(x) = 0 &\Rightarrow x^2 - 4x + 4 = 0 && (1)\\ &\Rightarrow (x-2)^2 = 0 && (2)\\ &\Rightarrow x - 2 = 0 && (3)\\ &\Rightarrow x = 2, && (4)\end{aligned}$$<br>which is typed as<br>`\begin{align}`<br>`% Line 1`<br>`f(x) = 0`<br>`% note that the & tells LaTeX where to line things up`<br>`% the \\ tells LaTeX to start a new line`<br>`&\Rightarrow x^2-4x+4=0 \\`<br>`% Line 2`<br>`&\Rightarrow (x-2)^2=0\\`<br>`% Line 3`<br>`&\Rightarrow x-2=0\\`<br>`% Line 4`<br>`&\Rightarrow x=2,`<br>`\end{align}` | ***Faculty Comments*** |

## p.314 # 159: A Truth Table — Grade:

To demonstrate that the following is true

$$P \rightarrow Q \equiv \sim (P \wedge \sim Q) \equiv \sim P \vee Q$$

we can use this truth table

| $P$ | $Q$ | $\sim P$ | $\sim Q$ | $P \rightarrow Q$ | $P \wedge \sim Q$ | $\sim (P \wedge \sim Q)$ | $\sim P \vee Q$ |
|---|---|---|---|---|---|---|---|
| $T$ | $T$ | $F$ | $F$ | $T$ | $F$ | $T$ | $T$ |
| $T$ | $F$ | $F$ | $T$ | $F$ | $T$ | $F$ | $F$ |
| $F$ | $T$ | $T$ | $F$ | $T$ | $F$ | $T$ | $T$ |
| $F$ | $F$ | $T$ | $T$ | $T$ | $F$ | $T$ | $T$ |

which is typeset using this code

```
\[
    % |*{8}{c|} gives 8 columns with
    % centered text in each
    \begin{array}{|*{8}{c|}}
    % header row
    % similar to align, & indicates a
    % new column and \\ ends a row
        P & Q & \sim P & \sim Q
            &  P \rightarrow Q
            & P\wedge \sim Q
            & \sim(P\wedge \sim Q)
            & \sim P\vee Q\\ \hline
    % row 1
        T & T & F & F & T & F & T & T \\
    % row 2
        T & F & F & T & F & T & F & F \\
    % row 3
        F & T & T & F & T & F & T & T \\
    % row 4
        F & F & T & T & T & F & T &  T \\
    \end{array}
\]
```

***Faculty Comments***

## p.271 # 8e: Some Set Stuff — Grade:

*Faculty Comments*

If $A = \{1, a, \alpha\}$, then

$$|\mathscr{P}(A)| = |\{\emptyset, \{1\}, \{a\}, \{\alpha\}, \{1, a\}, \{1, \alpha\}, \{a, \alpha\}, \{1, a, \alpha\}\}| = 8.$$

If we now let $B = A \cup \{2\}$ then

$$\begin{aligned}
|\mathscr{P}(B)| &= \left|\mathscr{P}(A) \cup \left(\bigcup_{S\in\mathscr{P}(A)} \{S \cup \{2\}\}\right)\right| && (5)\\
&= |\mathscr{P}(A)| + \left|\left(\bigcup_{S\in\mathscr{P}(A)} \{S \cup \{2\}\}\right)\right| && (6)\\
&= |\mathscr{P}(A)| + |\mathscr{P}(A)| && (7)\\
&= 8 + 8 && (8)\\
&= 16 && (9)
\end{aligned}$$

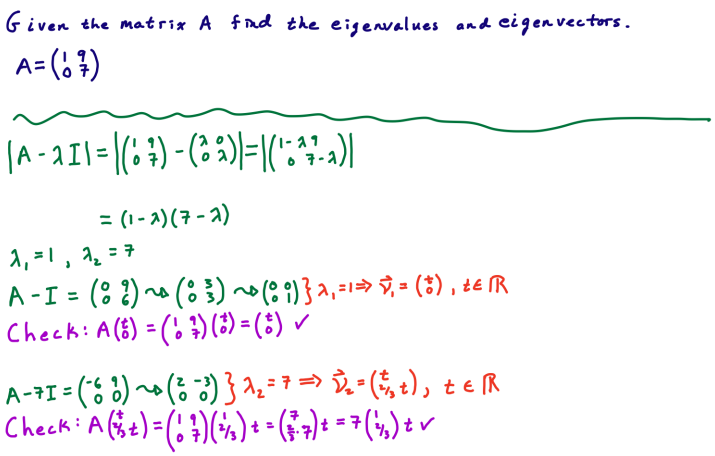
The above was typeset as follows:

```
\begin{align}
% row 1
    \left|\mathscr{P}(B)\right|
        &=\left|\mathscr{P}(A)\cup\left(
            \bigcup_{S\in\mathscr{P}(A)}\{S\cup \{2\}\}
        \right)\right| \\
% row 2
        &=\left|\mathscr{P}(A)\right|+\left|\left(
            \bigcup_{S\in\mathscr{P}(A)}\{S\cup \{2\}\}
        \right)\right| \\
% row 2
        &=\left|\mathscr{P}(A)\right|
        +\left|\mathscr{P}(A)\right| \\
% row 4
        &= 8+8\\
% row 5
        &= 16
\end{align}
```

Note in particular the use of `\left( ... \right)` to make really tall delimiters.

## p.667 # 10 e-13: Some Scrap Work — Grade:

Here is a picture of scrap work for a problem from linear algebra:




The code for including this, once it is uploaded, is:

```
\includegraphics[width=0.75\textwidth]{Linear_Scrap.png}
```

***Faculty Comments***

## p.662 # 10 e-36: Some Relations — Grade:

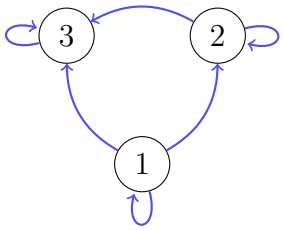
Define a relation from a set $A = \{1, 2, 3\}$ to itself by

$$a \, R \, b : a \leq b$$

The ordered pairs in this relation are

$$R = \{(1,1), (1,2), (1,3), (2,2), (2,3), (3,3)\}$$

which we can represent as a digraph by




which was drawn with the code:

```
\begin{tikzpicture}
%%%% Add nodes for each number
    \node[shape=circle,draw] (1) at (0,0) {1};
    \node[shape=circle,draw] (2) at (1,1.7) {2};
    \node[shape=circle,draw] (3) at (-1,1.7) {3};
%%%% Add edges between nodes
    \draw[->,color=blue!70,thick] (1) to[bend right] (2);
    \draw[->,color=blue!70,thick] (1) to[bend left] (3);
    \draw[->,color=blue!70,thick] (2) to[bend right] (3);
%%%% Add self referential edges
    \draw[->,color=blue!70,thick] (1) edge[loop below] (1);
    \draw[->,color=blue!70,thick] (2) edge[loop right] (2);
    \draw[->,color=blue!70,thick] (3) edge[loop left] (3);
\end{tikzpicture}
```

***Faculty Comments***