TeX code compiled with \documentclass{beamer} using the Amsterdam theme.
There is one png image needed to compile slides:

problem2.png

```
\begin{document} \begin{frame} \begin{block}{Steps to Solve a Related Rate} \begin{itemize} \item[\bf (i)] What
is variable?\\ What is constant? \vskip 2pt \item[\bf (ii)] Which rates are known?\\ Which rates need to be found?
\vskip 2pt \item[\bf (iii)] What equation relates the variables in (ii)? \vskip 2pt \item[\bf (iv)] Use Implicit
Differentiation on the equation in (iii) to relate the rates. \end{itemize} \end{block} If $V$ is the volume of a cube
with edge lengths $x$ and the cube expands as time passes, find $\frac{dV}{dt}$ in terms of $\frac{dx}{dt}$.
\begin{itemize} \item[\bf a)] What is $\frac{dV}{dx}$ when $x=4$ inches and is growing at a rate of $2$ inches
per minute? \item[\bf b)] What is $x$ if the volume is shrinking at $3$ cubic inches per minute and the side length
is shrinking at $4$ inches per minute? \item[\bf c)] Can a cube have a shrinking volume and a growing sides?
\end{itemize} \end{frame} \begin{frame} \large A spherical weather balloon is being inflated at a rate of \( 0.5
m^{3}/sec \). \vskip 5pt \begin{enumerate}[a)] \item How fast is the diameter increasing at the instant the
diameter is 2 meters? \vskip 15pt \item How fast is the volume changing at that same instant? \vskip 15pt \item
How fast is the surface area changing at that same instant? \end{enumerate} \end{frame} \begin{frame} \vskip
10pt As gravel is being poured into a conical pile, its volume $V$ changes with time. As a result, the height $h$ and
radius $r$ also change with time. Knowing that at any moment $V=\frac{1}{3}\pi r^2 h$, the relationship between
the changes with respect to time in the volume, radius and height is \vskip 10pt \begin{enumerate} \item
$\displaystyle{\frac{dV}{dt}=\frac{1}{3}\pi \left( 2r\frac{dr}{dt} h+r^2\frac{dh}{dt}\right)}$ \item
$\displaystyle{\frac{dV}{dt}=\frac{1}{3}\pi \left( 2r\frac{dr}{dt} \cdot \frac{dh}{dt}\right)}$ \item
$\displaystyle{\frac{dV}{dr}=\frac{1}{3}\pi \left( 2rh+r^2\frac{dh}{dt}\right)}$ \item
$\displaystyle{\frac{dV}{dh}=\frac{1}{3}\pi \left( (r^2)(1)+2r\frac{dr}{dh}h\right)}$ \end{enumerate}
\end{frame} \begin{frame} {\large Imagine the following magic triangle. Its base is on a horizontal surface and no
matter what you do to its height, the triangle always has area $10$ cm$^2$.} \vskip 20pt {\large If you push down
on the top of the triangle so that it becomes shorter at a rate of $3$ cm/sec, how fast will the length of the base be
changing when the triangle is $5$ cm tall?} \end{frame} \begin{frame} \large My neighbors have a very loud
stereo. The volume knob turns half a circle (angles $\theta$ between $0^\circ$ and $180^\circ$) and the volume of
the music is given by the function $V(\theta)=110\sin(\theta/2)$ decibels (dB). \vskip 20pt One night at $3:30$ in
the morning I notice an increase from a volume of $88$ dB at a rate of $1$ decibel per second! At what rate can I
deduce that my neighbor is turning his volume knob? \end{frame} \begin{frame} %%%%%%% Students should
discover errors in this "solution" {\small Water is leaking out of a tank shaped like a right circular cone with height
$5$ m and top radius $3$ m. When the water level in the cone is $2$ m, the water level is decreasing at a rate of
$0.1 \frac{m}{s}$. How fast is the water leaking out of the cone?} \pause \begin{columns}
\begin{column}{0.45\textwidth} \begin{center} \includegraphics[width=5cm]{problem2.png} \end{center}
\end{column} \pause \begin{column}{0.55\textwidth} {\small The volume of the water in the cone is $V =
\frac{1}{3}\pi r^2h$ and using the figure above and similar triangles $\frac{r}{h} = \frac{3}{5}$ \pause , which
means} $$ {\small r = \frac{3}{5}h = \frac{3}{5}2 = \frac{6}{5}.} $$ {\small This means that} $$ {\small V =
\frac{1}{3}\left(\frac{6}{5}\right)^2\pi h = \frac{12\pi}{25}h.} $$ \end{column} \end{columns} \pause {\small
Taking the derivative with respect to time} $$ {\small \frac{dV}{dt} = \frac{12\pi}{25}\frac{dh}{dt} =
\frac{12\pi}{25}\frac{1}{10} = \frac{6\pi}{125} \frac{m^3}{s}.} $$ \end{frame} \begin{frame} {\small Water
is leaking out of a tank shaped like a right circular cone with height $5$ m and top radius $3$ m. When the water
level in the cone is $2$ m, the water level is decreasing at a rate of $0.1 \frac{m}{s}$. How fast is the water
leaking out of the cone?} \begin{columns} \begin{column}{0.45\textwidth} \begin{center}
\includegraphics[width=5cm]{problem2.png} \end{center} \end{column} \begin{column}{0.55\textwidth} {\small
The volume of the water in the cone is $V = \frac{1}{3}\pi r^2h$ and using the figure above and similar triangles
$\frac{r}{h} = \frac{3}{5}$, which means} $$ {\small r = \frac{3}{5}h \ \ \ \ \xcancel{= \frac{3}{5}2 =
\frac{6}{5}.}} $$ {\small This means that} $$ {\small V =
\frac{1}{3}\left(\textcolor{red}{\frac{3}{5}h}\right)^2\pi h = \textcolor{red}{\frac{3\pi}{25}h^3}.} $$
\end{column} \end{columns} {\small Taking the derivative with respect to time} $$ {\small \frac{dV}{dt} =
\frac{3\pi}{25}\textcolor{red}{3h^2}\frac{dh}{dt} = \frac{3\pi}{25}\textcolor{red}{3(2)^2}\frac{\tr{-1}}{10}
```

= \textcolor{red}{\frac{-36\pi}{250}} \frac{m^3}{s}.} $$ \end{frame} \begin{frame} \large \begin{enumerate}[a)] \item A streetlight hangs 5 meters above the ground. Regina, who is 1.5 meters tall, walks away from the point under the light at a rate of 2 meters per second. How fast is her shadow lengthening when she is 7 meters away from the point under the light?\\ (Hint: Use similar triangles.) \vskip 25pt \item Suppose Regina has the ability to magically shrink herself. At what rate must she do this to keep her shadow a constant length of 3 meters? Write this as a function of only her distance from the point under the light. \end{enumerate} \end{frame} \begin{frame} \large A revolving beacon from a light house shines on the straight shore, and the closest point on the shore is a pier one half mile from the lighthouse. Let θ denote the angle between the lighthouse, pier, and point on the shore where the light shines. \begin{enumerate} \item Write the distance from the pier to the point of light as a function of θ. \item What is the rate of change of the distance from the pier to the point of light with respect to θ. \item Suppose θ is a function of time t. Give an expression for the rate of change of distance with respect to time t. \item Suppose that the light makes 1 revolution per minute. How fast is the light traveling along the straight beach at the instant it pases over a shorepoint 1 mile away from the shorepoint nearest the searchlight? \end{enumerate} \end{frame} \begin{frame} \large Given that a spherical raindrop evaporates at a rate proportional to its surface area, how fast does the radius shrink? \vskip 60pt The minute hand on a watch is 8 mm long and the hour hand is 4 mm long. How fast is the distance between the tips of the hands changing at one o'clock? \end{frame} \begin{frame} \large \begin{enumerate}[a)] \item Find the shortest line segment with endpoints on the x and y axes going through the point $(1,8)$. \vskip 15pt \item What is the area of the triangle formed by the shortest line segment? \vskip 15pt \item What is the rate of change of area with respect to the x-coordinate of the point on the x-axis? \vskip 15pt \item For which x is the area increasing? \end{enumerate} \end{frame} \begin{frame} \large The speed limit on a stretch of highway is 55 mph. Highway patrol officer, Sgt. Miguel, stations himself at a point, out of view of the motorists, 50 feet off the highway. Miguel is equipped with a radar gun which measures the speed at which a car approaches {\bf his position}. \vskip 15pt He takes a reading of suspected speeders by pointing his radar gun at a point on the highway 120 feet from the point on the highway closest to him. The radar gun picks up a reading of 48 feet/sec for a green Chevy driven by Alyssa. How fast is she traveling? Is Alyssa speeding? \end{frame} \begin{frame} \large At a certain moment, ship \(A \) is 6 miles south and 8 miles west of ship \(B \) . Ship \(A \) at that moment is steaming east at 12 mph, while ship \(B \) is steaming north at 15 mph. \vskip 15pt Are the ships approaching each other or separating from each other? At what rate? \end{frame} \begin{frame} \large Particle A moves along the positive horizontal axis, and particle B along the graph of $$ f(x) = -\sqrt 3x,\;x\leq 0.$$ At a certain time, A is at the point $(5,0)$ and moving with speed 3 units/sec; and B is at a distance of 3 units from the origin moving with speed 4 units/sec. At what rate is the distance between A and B changing? \end{frame} \end{document}