Lecture 32

- Covers
  - Introduction to applets
  - HTML basics
  - The paint( ) method
- Reading: Savitch 13.2, 13.3

Lecture outline

- Introduction to applets
- Notes on HTML
- Displaying text, controlling colors and fonts
- Drawing shapes

- Introduction to applets

Applications vs applets

- Java has two kinds of launcher programs
  - Java applications: programs that are launched from the operating system's console window (also known as stand-alone programs)
  - Java applets: programs that are launched inside a web browser
- For testing purpose, applets can be displayed by the applet viewer

Applets

- To prepare and run an applet, we do the following

1. Write the applet program
2. Compile it
3. Write an html file (which has a tag to display the applet)
4. Display the html file using a web browser or the applet viewer

- Notes on HTML

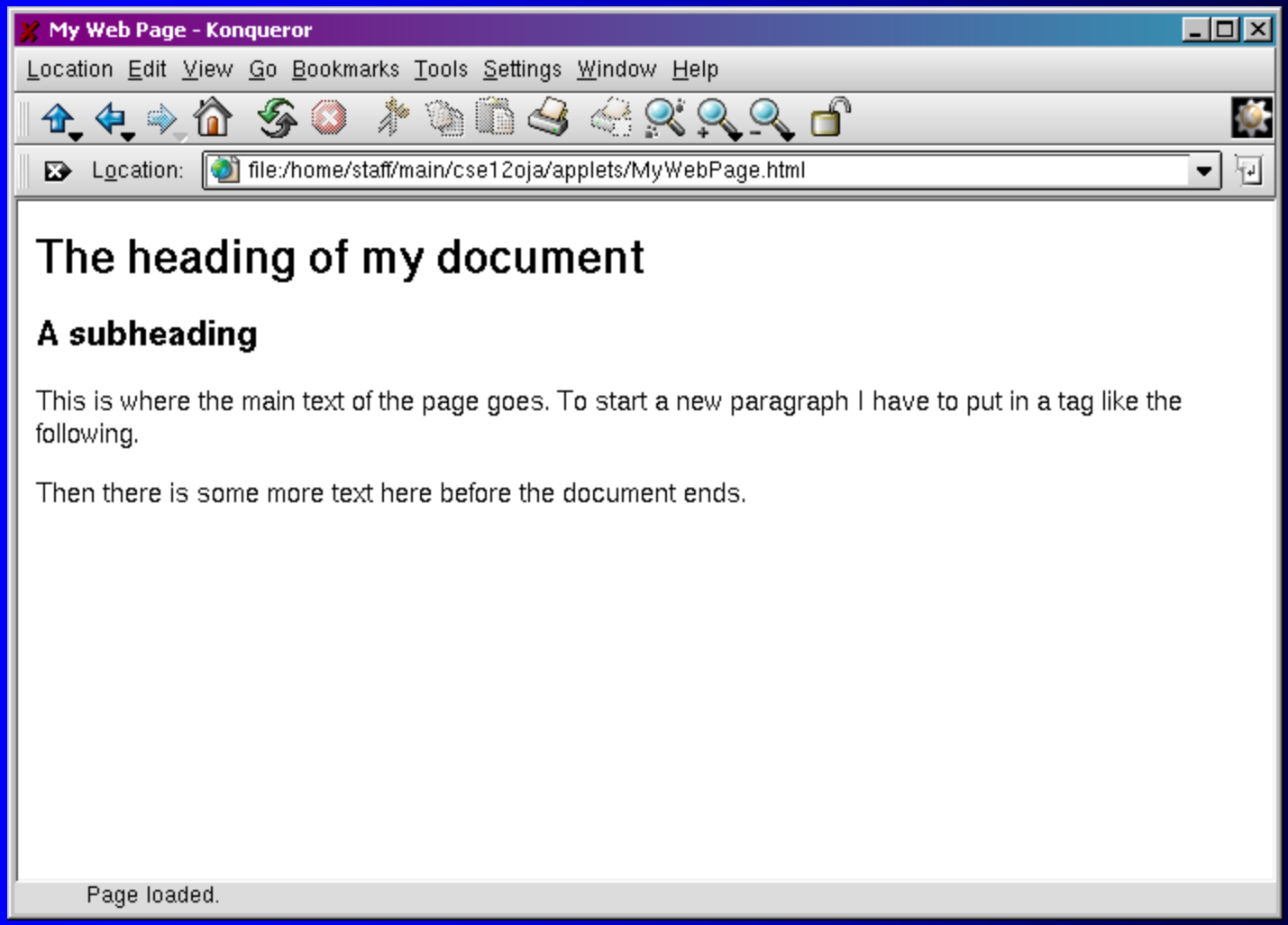
HTML

- Hypertext Markup Language
- Hypertext – text that may contain links to other documents
- Contains formatting information that determines how a page is displayed in a web browser
- The formatting information is specified with tags

HTML page example

```
<html>
<head>
<title> My Web Page
</title>
</head>
<body>
<h1> The heading of my document </h1>
<h2> A subheading </h2>
This is where the main text of the page goes. To start a new paragraph I have to put in a tag like the following.
<p>
Then there is some more text here before the document ends.
</body>
</html>
```

HTML page example

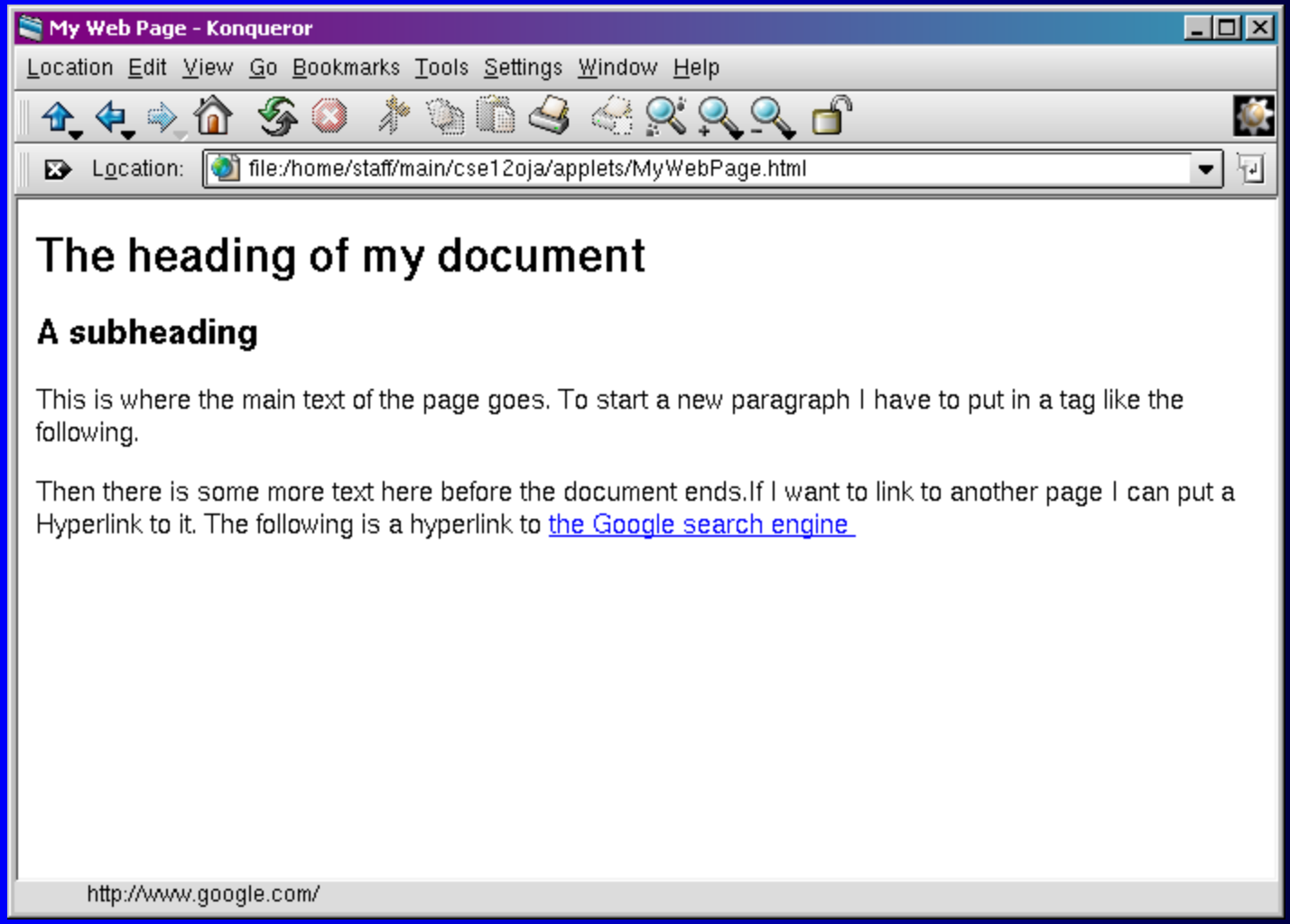


Hyperlinks

- To link to other pages, we have to specify in a tag the URL (Unique Resource Locator) of the page

<body>
<h1> The heading of my document </h1>
<h2> A subheading </h2>
This is where the main text of the page goes. To start a new paragraph I have to put in a tag like the following.
<p>
Then there is some more text here before the document ends.
If I want to link to another page I can put a Hyperlink to it. The following is a hyperlink to <A href = "http://www.google.com/"> the Google search engine </A>
</body>

Hyperlinks


My Web Page - Konqueror
Location Edit View Go Bookmarks Tools Settings Window Help
Location: file:/home/staff/main/cse12oja/applets/MyWebPage.html
The heading of my document
A subheading
This is where the main text of the page goes. To start a new paragraph I have to put in a tag like the following.
Then there is some more text here before the document ends.If I want to link to another page I can put a Hyperlink to it. The following is a hyperlink to the Google search engine
http://www.google.com/

Applets in HTML pages

- To include an applet in an HTML page, we have to use a command

<body>
<h1> The heading of my document </h1>
<h2> A subheading </h2>
This is where the main text of the page goes. To start a new paragraph I have to put in a tag like the following.
<p>
Then there is some more text here before the document ends. If I want to link to another page I can put a Hyperlink to it. The following is a hyperlink to <A href = "http://www.google.com/"> the Google search engine </A>. If I want to include an applet instead I do so as follows:
<applet code = "HelloApplet.class" width = 500 height = 300>
</applet>
</body>

Applets in HTML pages

- Rather than using a web page to view the applet, we can run and test an applet in the appletviewer

```
appletviewer MyWebPage.html
```

- The appletviewer brings up one window for each applet in the html file

- A first applet

A first applet

```
import java.applet.Applet;
import java.awt.*;

public class HelloApplet extends Applet
{
    public void paint(Graphics g)
    {
        setBackground (Color.blue);
        g.setColor(Color.orange);
        g.fillRect(50,50,200,200);
        g.setColor(Color.blue);
        g.fillOval(52,52,196,196);
        g.setColor(Color.yellow);
        g.drawString("Hello World!", 100, 150);
    }
}
```

Create a class that is a type of Applet using "extends"

Applets do not have a main method but have a paint method

A first applet

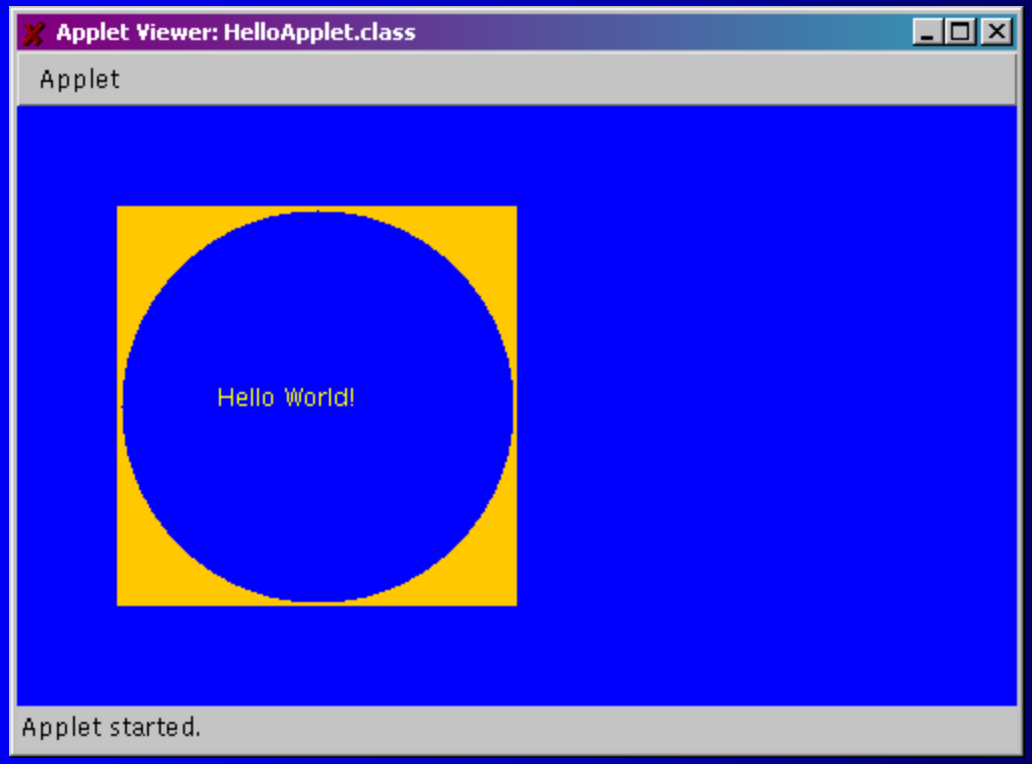
- HTML file HelloApplet.html

```
<applet code = "HelloApplet.class" width = 500
  height = 300>
</applet>
```

- View applet with web browser
- View applet with applet viewer

```
appletviewer HelloApplet.html
```

A first applet



A first applet

```
import java.applet.Applet;
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public class HelloApplet extends Applet
{
    public void paint(Graphics g)
    {
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        g.fillRect(50,50,200,200);
        g.setColor(Color.blue);
        g.fillOval(52,52,196,196);
        g.setColor(Color.yellow);
        g.drawString("Hello World!", 100, 150);
    }
}
```

The web browser or applet viewer calls the paint method

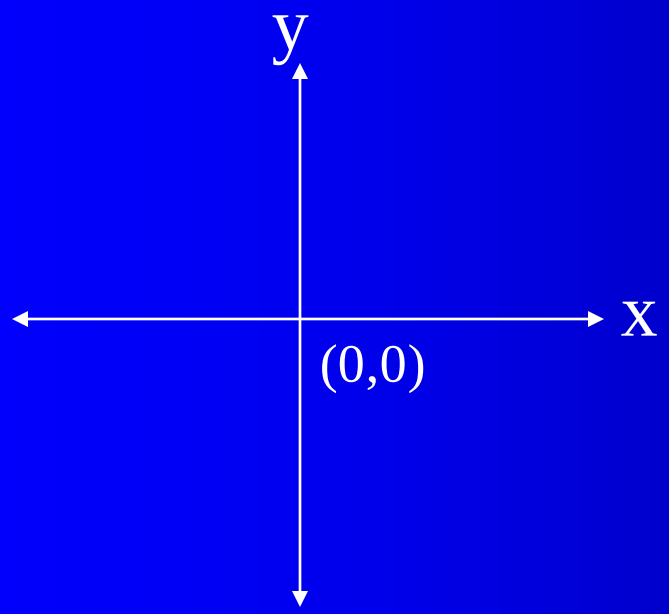
The paint method takes a Graphics object as a parameter. Graphics objects store the current graphics state (colours, fonts, etc.) for drawing operations

- Displaying text, controlling colours and fonts

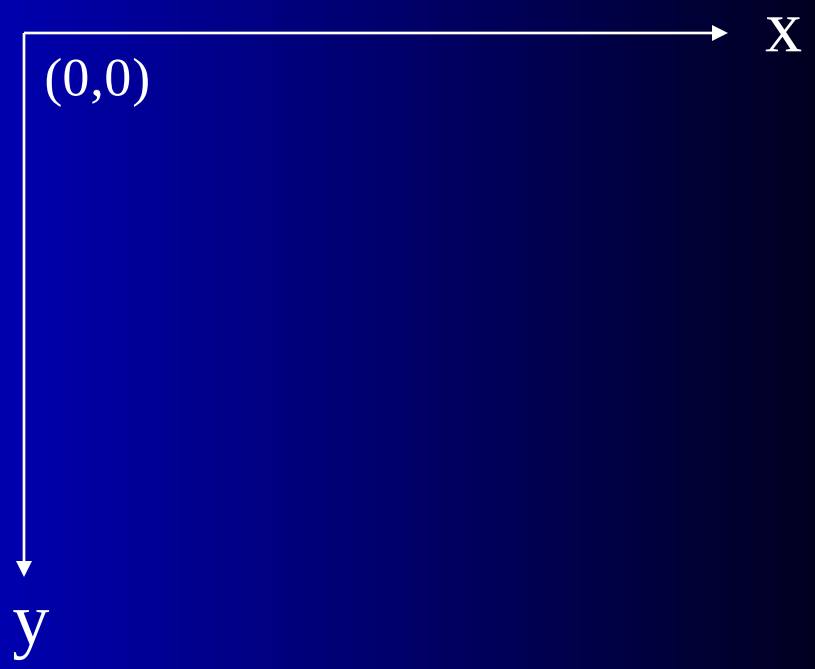
Coordinate systems

- Pictures are represented by a collection of pixels
- Each pixel can be referred to individually by giving its coordinates
- Graphical Java applets use a coordinate system to place text and pictures in the applet window

Coordinate systems



Traditional coordinate system



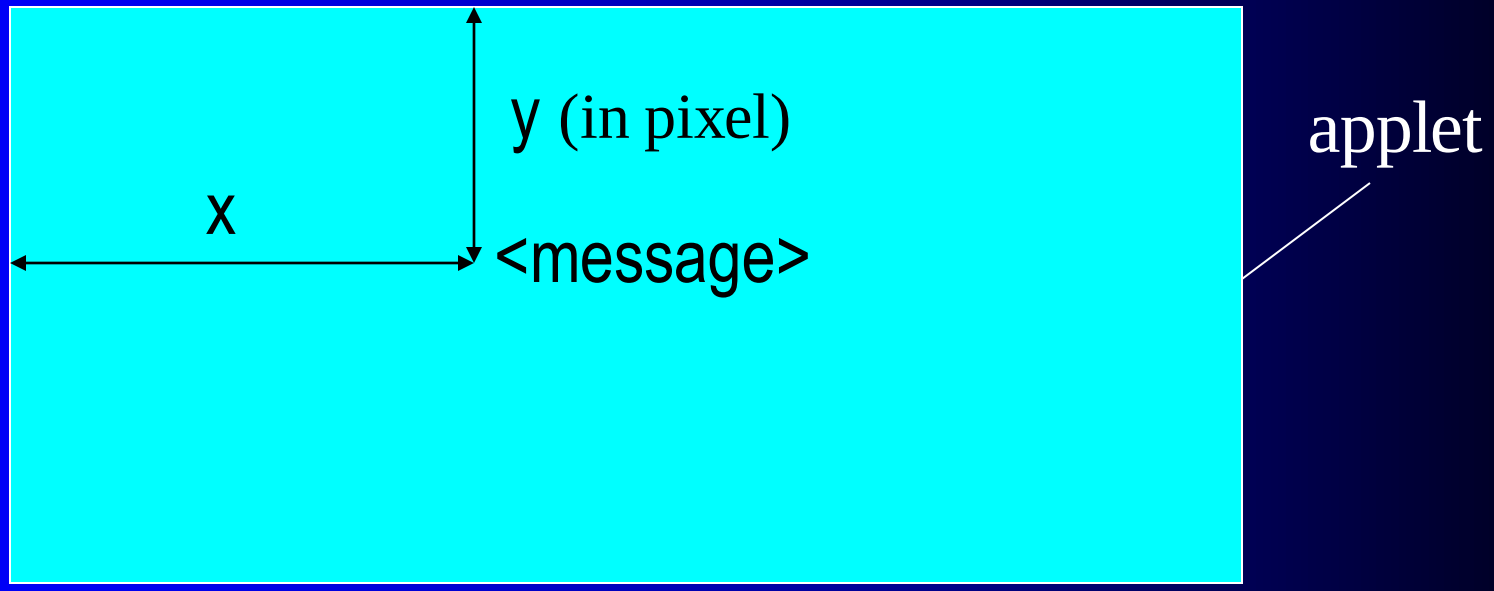
Java coordinate system

Displaying text

- Use method

  drawString(String message, int x, int y)

  of the Graphics class



Using colours and fonts

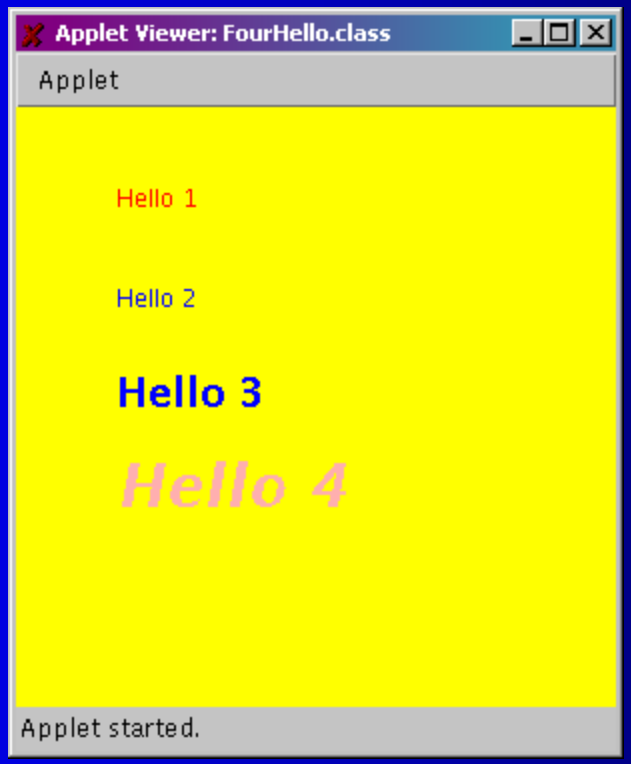
```
public void paint(Graphics g)
{
    setBackground(Color.yellow);
    g.setColor(Color.red);
    g.drawString("Hello 1", 50, 50);          // in red

    g.setColor(Color.blue);
    g.drawString("Hello 2", 50, 100);         // in blue

    g.setFont(new Font("Arial", Font.BOLD, 20));
    g.drawString("Hello 3", 50, 150);         // in new font

    g.setColor(Color.pink);
    g.setFont(new Font("Arial", Font.BOLD + Font.ITALIC, 30));
    g.drawString("Hello 4", 50, 200);         // new font and color
}
```

Using colours and fonts



Setting background colour

- Use method

  setBackground(Color color)

- This is a method of the Applet class

- To set the background colour, invoke for example

  setBackground(Color.yellow)

Setting drawing colour

- Use method

  setColor(Color color)

- This is a method of the Graphics class
- To set the drawing colour, send the following message to the Graphics object

  g.setColor(Color.red)

- Effect will take place for subsequent drawing instructions

Creating colours

- Any colour can be represented as a mix of the three primary colours: red, green and blue
- We can create objects to represent colours using the Color class and the constructor

  Color(int r, int g, int b)
- where r, g, b are the red, green and blue components that make up the colour
- r, g and b are integers between 0 and 255 inclusive

Examples

red	green	blue	color
255	0	0	red
0	255	0	green
0	0	255	blue
255	255	0	yellow
0	0	0	black
255	255	255	white

Pre-defined colours

- The Color class defines some objects to represent the following standard colours

black	*blue*	*cyan*	*darkGray*
gray	*green*	*magenta*	*lightGray*
orange	*pink*	*red*	*white*
yellow			

Example

- Write an applet to display the message "Hello" 4 times on the screen in 4 random colours
- To generate a random colour

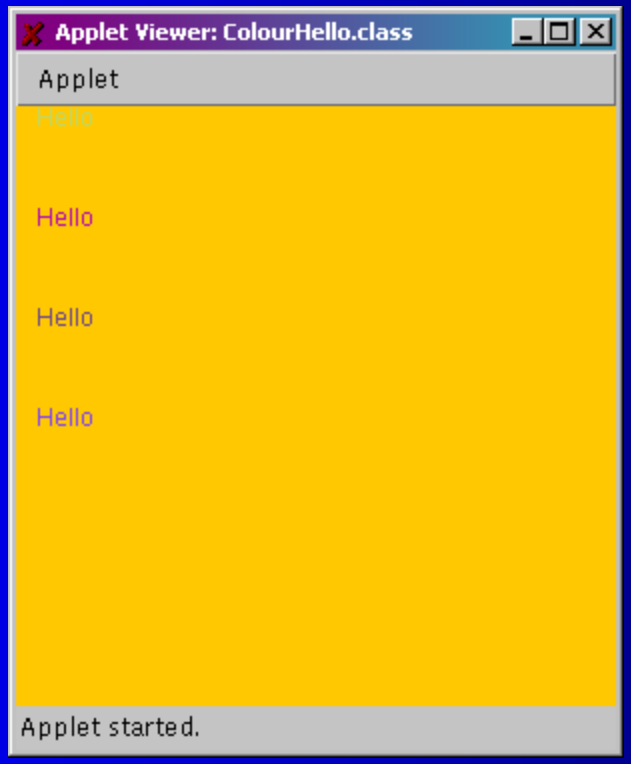
```
int red = (int) (Math.random( ) * 256);
int green = (int) (Math.random( ) * 256);
int blue = (int) (Math.random( ) * 256);

Color c = new Color(red, green, blue);
```

Four Hello applet

```
import java.applet.Applet;
import java.awt.*;
public class ColourHello extends Applet
{
    public void paint(Graphics g)
    {
        setBackground(Color.orange);
        int red, green, blue;
        for (int i = 0; i < 4; ++i)
        {
            red = (int) (Math.random( ) * 256);
            green = (int) (Math.random( ) * 256);
            blue = (int) (Math.random( ) * 256);
            Color c = new Color(red, green, blue);
            g.setColor(c);
            g.drawString( "Hello", 10, 10 + 50 * i );
        }
    }
}
```

Four Hello applet



Creating fonts

- Font objects contain font formatting information

```
Font(String fontType, int fontStyle, int fontSize)
```

where fontType can be

"Serif" "SansSerif" "MonoSpaced"
"Dialog" "DialogInput"

and fontStyle can be

Font.PLAIN Font.BOLD
Font.ITALIC Font.BOLD + Font.ITALIC

- Displaying shapes

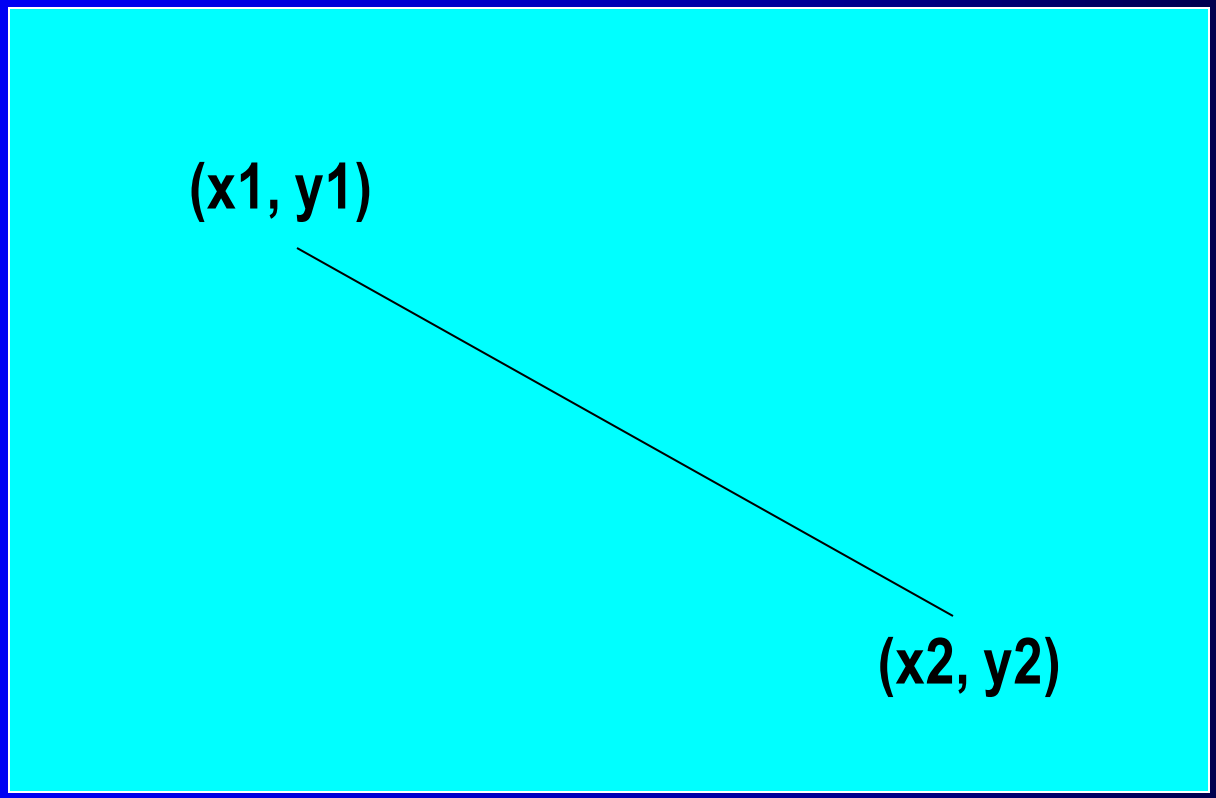
Displaying shapes

- Methods of the Graphics class draw the outlines of shapes

```
drawLine(int x1, int y1, int x2, int y2)
drawRect(int x, int y, int width, int height)
drawOval(int x, int y, int width, int height)
drawArc(int x, int y, int width, int height,
        int startAngle, int extent)
```

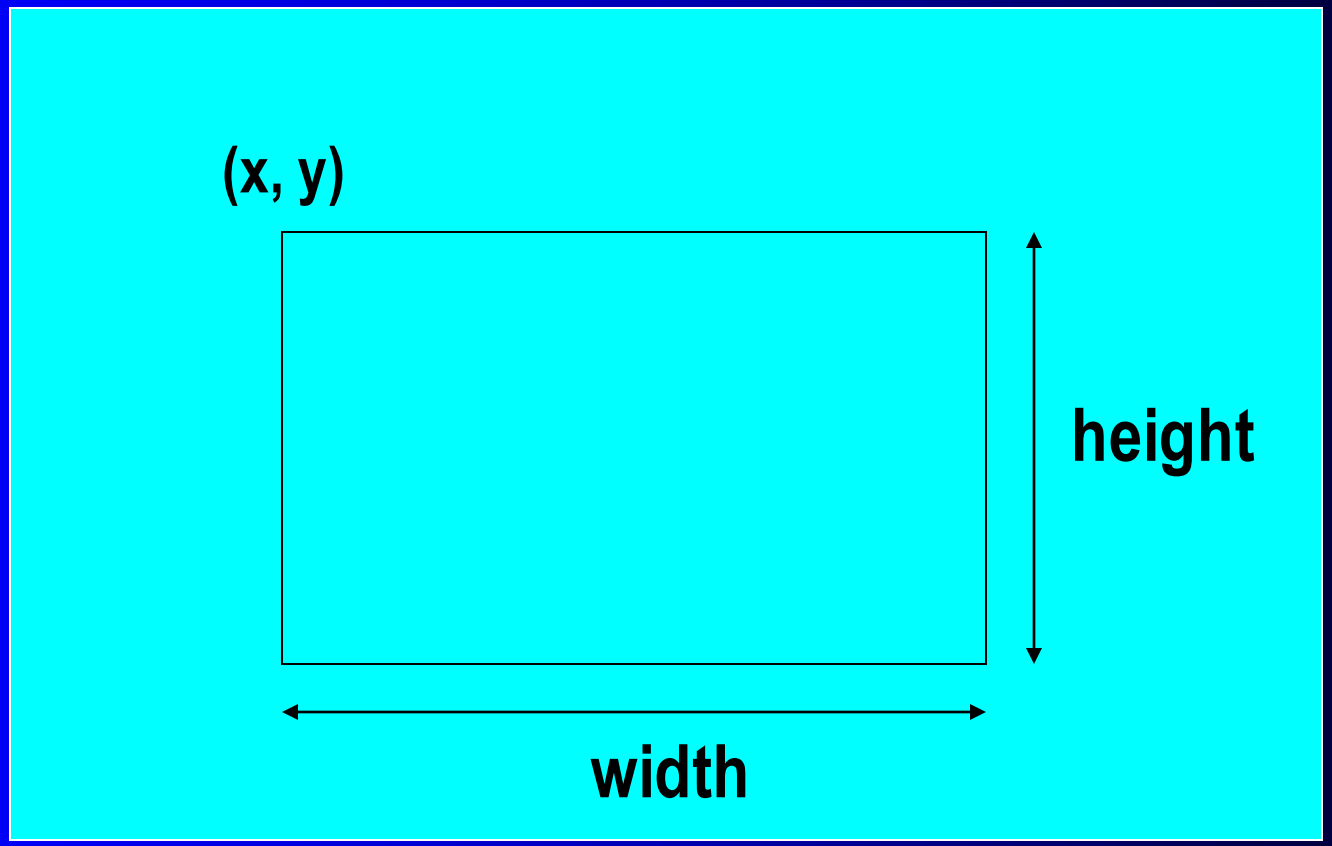
Drawing lines

drawLine(int x1, int y1, int x2, int y2)



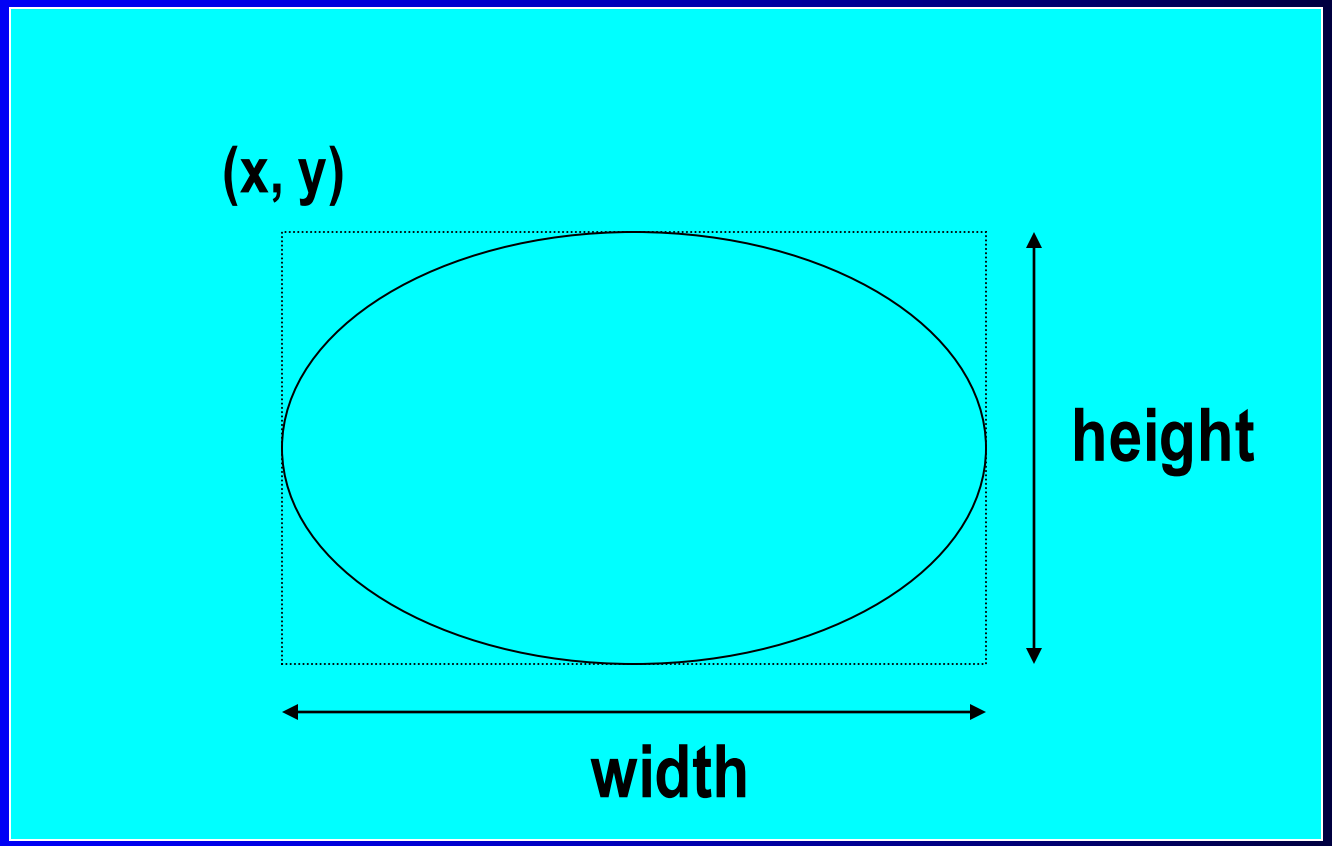
Drawing rectangles

drawRect(int x, int y, int width, int height)



Drawing ovals

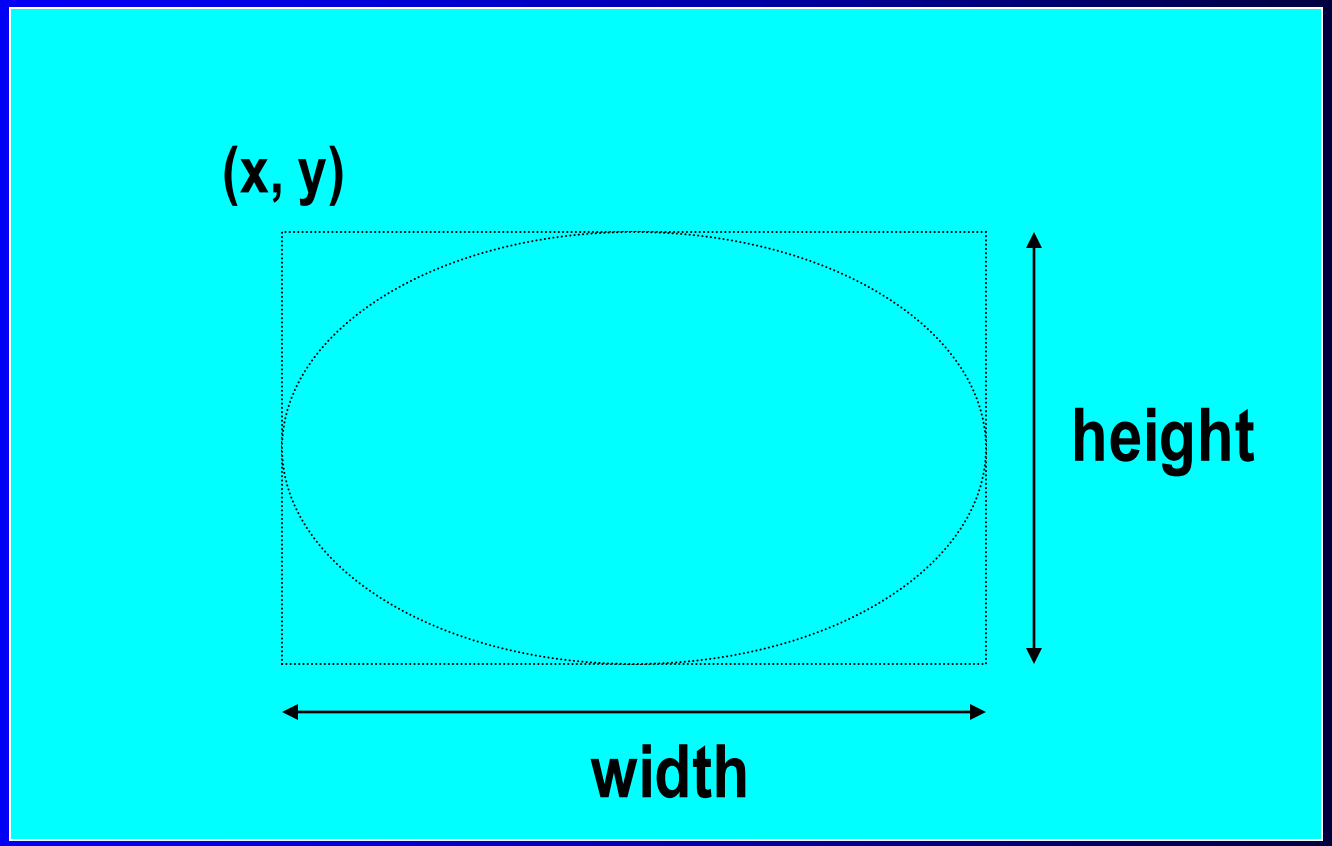
drawOval(int x, int y, int width, int height)



** parameters refer to the bounding box*

Drawing arcs

drawArc(int x, int y, int width, int height,
int startAngle, int extent)



** Diagram to be completed in class*

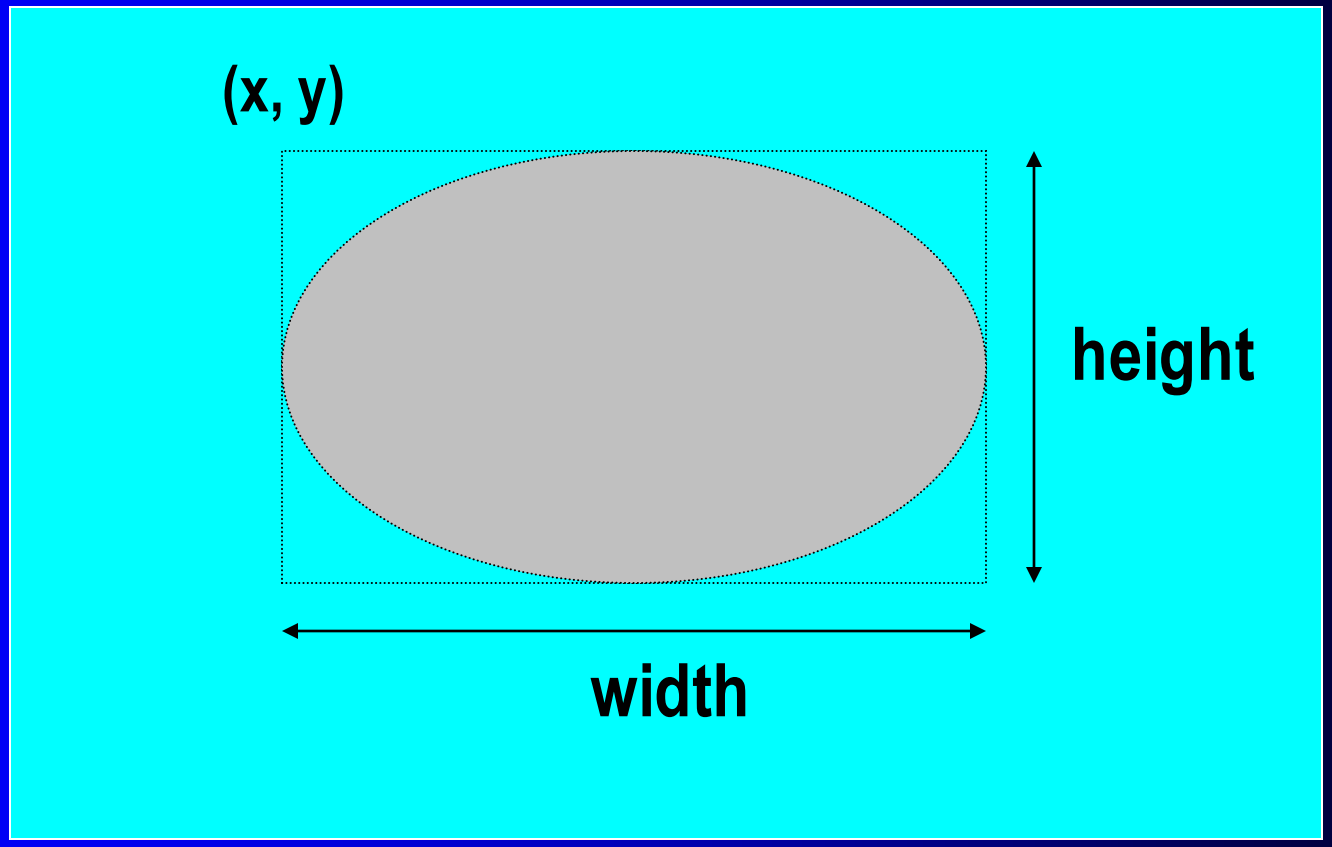
Displaying solid shapes

- Methods to display solid shapes

```
fillRect(int x, int y, int width, int height)
fillOval(int x, int y, int width, int height)
fillArc(int x, int y, int width, int height,
        int startAngle, int extent)
```

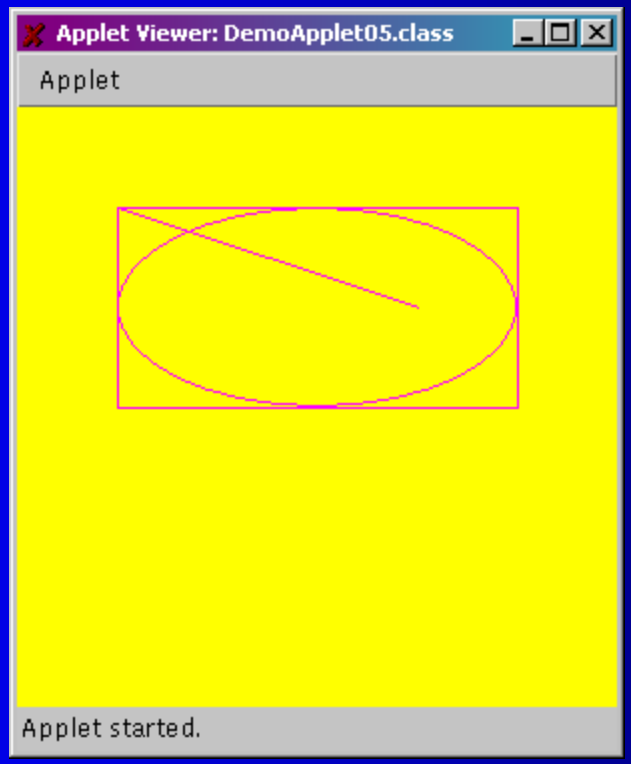
Displaying solid ovals

fillOval(int x, int y, int width, int height)



Class exercise 1

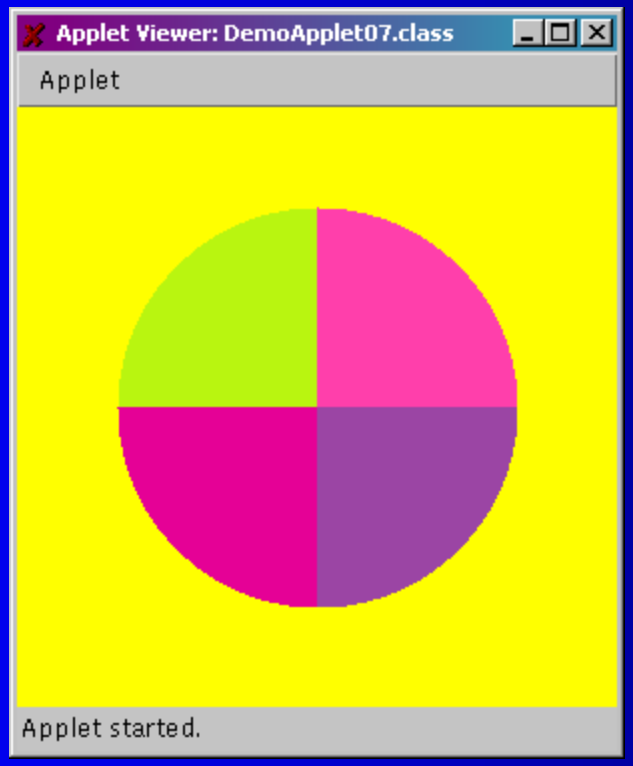
- An applet to draw a line, a rectangle, and an oval



Solution

Class exercise 2

- An applet to paint the four quadrants of a circle with four different colors



Solution

Next lecture

- Applet examples
  - Calculating coordinates and sizes
  - Rectangles and polygons