

Panel 1

From Math: Intermediate Value Theorem

$$\left. \begin{array}{l} f(a) > 0 \text{ and } f(b) < 0 \\ \text{or } f(a) < 0 \text{ and } f(b) > 0 \end{array} \right\} \Rightarrow f(c) = 0 \text{ (f cont.)}$$

Ex:
 $f(x) = x^2 - 2$ on $[0, 2]$

$$a = 0, b = 2 \checkmark$$

$f(a) < 0, f(b) > 0$ theorem applies so find $f(c) = 0$

$$x_{\text{plus}} = b \checkmark \text{ and } x_{\text{minus}} = a \checkmark$$

$$x_{\text{middle}} = (a+b)/2 = 1 \quad \leftarrow \text{repeat}$$

$f(x_{\text{middle}})$ is neg., replace x_{minus} with x_{middle}
 otherwise replace x_{plus} with x_{middle}

Panel 2

identified loop \checkmark

if \checkmark

5 variables \checkmark

$$f(x) = x^2 - 2$$

\Rightarrow write program

posted on next two slides

Panel 3

```

public class Bisect
{
    public static double f(double x)
    {
        return Math.pow(x,5) - 3*Math.pow(x,2) + 7*x -1;
    }

    public static void main(String args[])
    {
        double a, b;
        double x_minus = 0.0, x_plus = 0.0;
        double x_middle = 0.0;

        System.out.print("Enter a: ");
        a = Console.readDouble();
        System.out.print("Enter b: ");
        b = Console.readDouble();
    }
}

```

to be continued on next slide

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Panel 4

Continued from before

```

    if ((f(a) < 0) && (f(b) > 0))
    {
        x_minus = a;
        x_plus = b;
    }
    else if ( (f(a) > 0) && (f(b) < 0))
    {
        x_minus = b;
        x_plus = a;
    }
    else
    {
        System.out.println("IVT does not apply");
        System.exit(-1);
    }

    while ( Math.abs(f(x_middle)) > 10E-10)
    {
        x_middle = (x_plus + x_minus)/2.0;
        if (f(x_middle) > 0)
        {
            x_plus = x_middle;
        }
        else if (f(x_middle) < 0)
        {
            x_minus = x_middle;
        }
    }

    System.out.println("f(" + x_middle + " = " + f(x_middle));
}
}

```

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Panel 5

Write a program to compute area + perimeter
of a circle, using one or more functions as
well as user input!

Enter $r = ?$

\Rightarrow circ is ...

area is ----

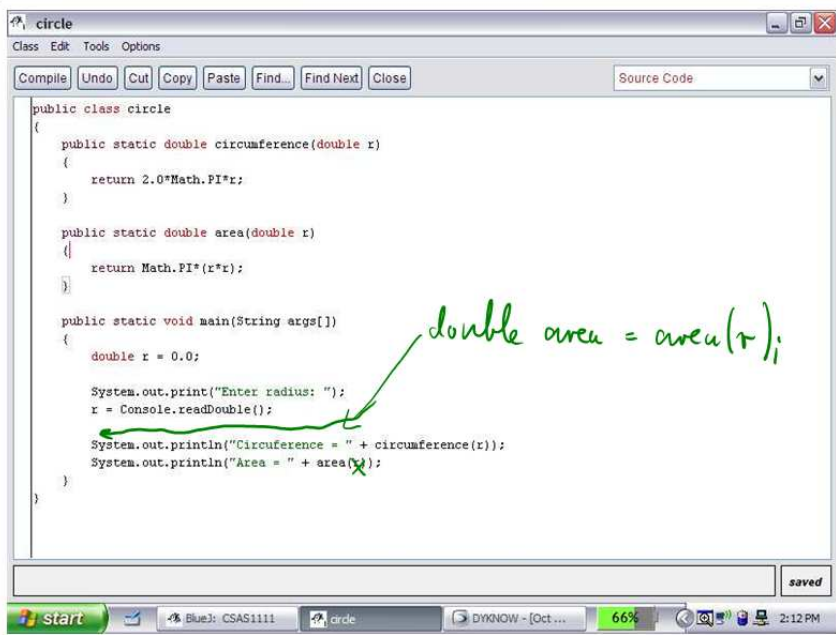
Formulas: $circ = 2\pi r$, $area = \pi r^2$

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Panel 6

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Panel 7



The screenshot shows a Java IDE window titled 'circle'. The code is as follows:

```
public class circle
{
    public static double circumference(double r)
    {
        return 2.0*Math.PI*r;
    }

    public static double area(double r)
    {
        return Math.PI*(r*r);
    }

    public static void main(String args[])
    {
        double r = 0.0;

        System.out.print("Enter radius: ");
        r = Console.readDouble();

        System.out.println("Circumference = " + circumference(r));
        System.out.println("Area = " + area(r));
    }
}
```

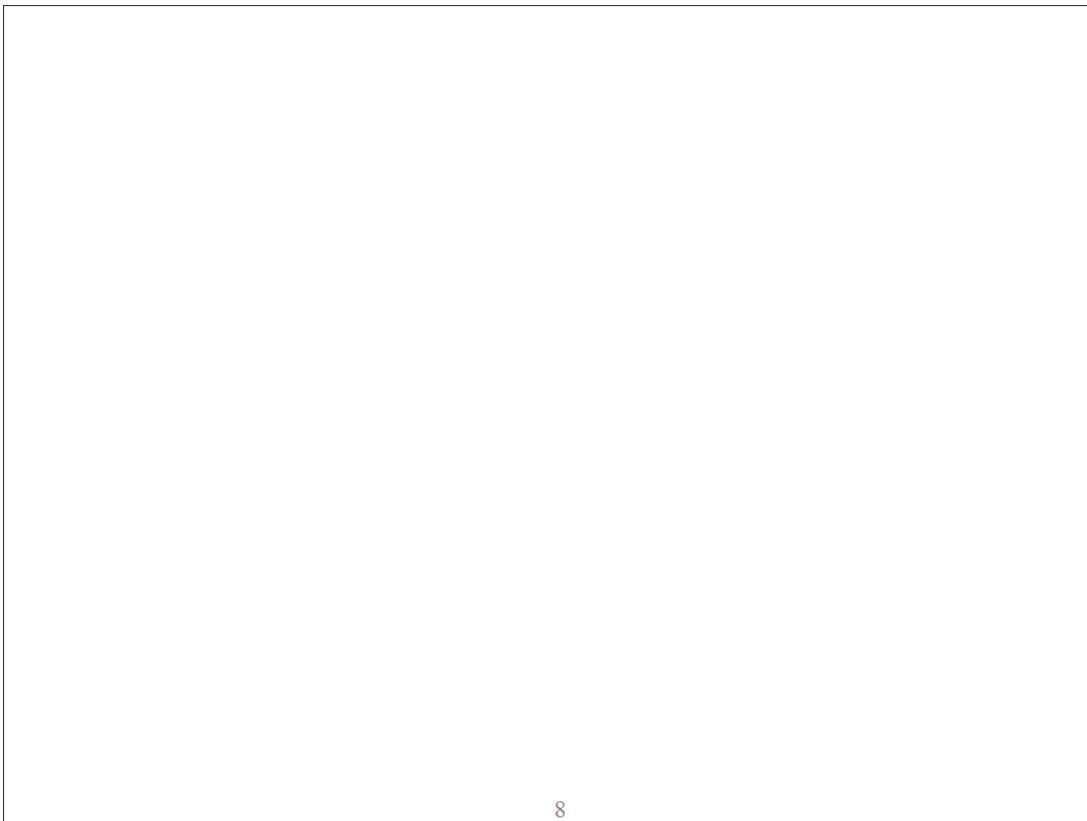
Handwritten green annotations include:

- A line pointing to the `r = Console.readDouble();` line with the text `double area = area(r);`.
- A checkmark next to the `area(r)` argument in the `System.out.println("Area = " + area(r));` line.

The IDE interface includes a menu bar (Class, Edit, Tools, Options), a toolbar (Compile, Undo, Cut, Copy, Paste, Find..., Find Next, Close), and a 'Source Code' dropdown. The Windows taskbar at the bottom shows the Start button, a taskbar with 'Blue: CSAS1111', 'circle', and 'DYKNOW - [Oct...]', a 66% zoom level, and a system tray with the time '2:12 PM'.

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Panel 8



8

Panel 9

```

1  public class Squared
2  {  public static double square(double x)
3     {  return x*x; }
4     public static int cube(int i)
5     {  return i*i*i; }
6     public static double power(double base, int exp)
7     {  double result = 1;
8         for (int i = 1; i <= exp; i++)
9             result *= base;
10        return result;
11    }
12    public static void main(String args[])
13    {  double x = 2.0;
14        ✓ double y = square(square(square(x)));
15        System.out.println("x: " + x + ", y: " + y); ✓
16
17        int i = 2;
18        int j = cube(cube(cube(i))); ✓
19        System.out.println("i: " + i + ", j: " + j);
20
21        int z = cube square(i); compile error
22        int w = square(cube(i));
23
24        System.out.println(power(square(x)+cube(i), 4/3+1)); ✓
25    }
26 }

```

Handwritten annotations in green:

- Arrow pointing to `cube(int i)`
- Underline under `double` in `square(double x)`
- Underline under `double` in `power(double base, int exp)`
- Underline under `double` in `main` parameter list
- Underline under `double` in `double y = square(square(square(x)))`
- Underline under `square(x)` in `double y = square(square(square(x)))`
- Underline under `square(x)+cube(i)` in `power(square(x)+cube(i), 4/3+1)`
- Underline under `4/3+1` in `power(square(x)+cube(i), 4/3+1)`
- Underline under `double` in `power` parameter list
- Underline under `double` in `power` parameter list
- Underline under `int` in `power` parameter list
- Underline under `cube` in `int z = cube square(i)`
- Underline under `square(i)` in `int z = cube square(i)`