// deriv.java - approximate derivative function

public class deriv1a

{

 static double f(double x)

 {

 return x\*x\*x - 2.0\*x\*x + 3.0\*x - 8.0;

 } // f

 static double real\_fderiv(double x)

 {

 return 3.0\*x\*x - 4.0\*x + 3.0;

 } // f

 static double approx\_fderiv(double x, double eps)

 {

 double h, fd0, fd1;

 double f1, f2;

 h = x/2.0;

 fd1 = (f(x+h) - f(x-h))/(2\*h);

 do {

 fd0 = fd1;

 h = h/2.0;

 fd1 = (f(x+h) - f(x-h))/(2\*h);

 f1 = f(x+h);

 f2 = f(x-h);

 System.out.println("fd0 = " + fd0 +",fd1 = "+ fd1);

 } while(Math.abs(fd0 - fd1) > eps );

 return fd1;

 } // approx\_deriv

 static public void main(String args[])

 {

 System.out.println("approx\_deriv(5.0) = " +

 approx\_fderiv(5.0,0.0001));

 System.out.println("real\_fderiv(5.0) = " +

 real\_fderiv(5.0));

 } // main

} // deriv1a.java

פלט ריצה:

fd0 = 64.25,fd1 = 59.5625

fd0 = 59.5625,fd1 = 58.390625

fd0 = 58.390625,fd1 = 58.09765625

fd0 = 58.09765625,fd1 = 58.0244140625

fd0 = 58.0244140625,fd1 = 58.006103515625

fd0 = 58.006103515625,fd1 = 58.00152587890625

fd0 = 58.00152587890625,fd1 = 58.00038146972656

fd0 = 58.00038146972656,fd1 = 58.00009536743164

fd0 = 58.00009536743164,fd1 = 58.00002384185791

approx\_deriv(5.0) = 58.00002384185791

real\_fderiv(5.0) = 58.0

// fderiv1a.c - approximate derivative function

public class fderiv1a

{

 static final double PI = 3.14159265;

 static double f(double x)

 {

 return Math.sin(x);

 } // f

 static double approx\_fderiv(double x)

 {

 double h, fd0, fd1, fd2;

 if( x == 0)

 h = 1/2.0;

 else

 h = x/2.0;

 fd1 = (f(x+h) - f(x-h))/(2\*h);

 h = h/2.0;

 fd2 = (f(x+h) - f(x-h))/(2\*h);

 do {

 fd0 = fd1;

 fd1 = fd2;

 h = h/2.0;

 fd2 = (f(x+h) - f(x-h))/(2\*h);

 } while(Math.abs(fd0 - fd1) > Math.abs(fd1 - fd2) );

 return fd1;

 } // approx\_deriv

 public static void main(String args[])

 {

 System.out.println("approx\_deriv(0.0) = " + approx\_fderiv(PI/6.0));

 System.out.println("real\_fderiv(0.0) = " + Math.cos(PI/6.0));

 } // main

} // fderiv1a

פלט ריצה:

approx\_deriv(0.0) = 0.8660254040912695

real\_fderiv(0.0) = 0.8660254040835881

// deriv2a.java

abstract class deriv

{

 public abstract double f(double x);

 double approx\_deriv(double x, double eps)

 {

 double h, fd0, fd1;

 double f1, f2;

 h = x/2.0;

 fd1 = (f(x+h) - f(x-h))/(2\*h);

 do {

 fd0 = fd1;

 h = h/2.0;

 fd1 = (f(x+h) - f(x-h))/(2\*h);

 f1 = f(x+h);

 f2 = f(x-h);

 System.out.println("fd0 = " + fd0 +",fd1 = "+ fd1);

 } while(Math.abs(fd0 - fd1) > eps );

 return fd1;

 } // approx\_deriv

} //deriv

class myfun extends deriv

{

 public double f( double x)

 {

 return (x\*x\*x - 100.0);

 } /\* poly \*/

 public double real\_deriv( double x)

 {

 return (3\*x\*x);

 } /\* poly \*/

} //myfun

public class deriv2a

{

 public static void main(String[] args)

 {

 double x;

 myfun tr100 = new myfun();

 System.out.println("approx\_deriv(5.0) = " +

 tr100.approx\_deriv(5.0, 0.0000001));

 System.out.println("real\_deriv(5.0) = " +

 tr100.real\_deriv(5.0));

 } // main

}// deriv2a

פלט ריצה:

fd0 = 81.25,fd1 = 76.5625

fd0 = 76.5625,fd1 = 75.390625

fd0 = 75.390625,fd1 = 75.09765625

fd0 = 75.09765625,fd1 = 75.0244140625

fd0 = 75.0244140625,fd1 = 75.006103515625

fd0 = 75.006103515625,fd1 = 75.00152587890625

fd0 = 75.00152587890625,fd1 = 75.00038146972656

fd0 = 75.00038146972656,fd1 = 75.00009536743164

fd0 = 75.00009536743164,fd1 = 75.00002384185791

fd0 = 75.00002384185791,fd1 = 75.00000596046448

fd0 = 75.00000596046448,fd1 = 75.00000149011612

fd0 = 75.00000149011612,fd1 = 75.00000037252903

fd0 = 75.00000037252903,fd1 = 75.00000009313226

fd0 = 75.00000009313226,fd1 = 75.00000002328306

approx\_deriv(5.0) = 75.00000002328306

real\_deriv(5.0) = 75.0

// deriv3a.java - fderiv's method

interface DoubleFunction

{

 public double f(double x);

} // DoubleFunction

class deriv

{

 double approx\_deriv(DoubleFunction df, double x, double eps)

 {

 double h, fd0, fd1;

 double f1, f2;

 h = x/2.0;

 fd1 = (df.f(x+h) - df.f(x-h))/(2\*h);

 do {

 fd0 = fd1;

 h = h/2.0;

 fd1 = (df.f(x+h) - df.f(x-h))/(2\*h);

 f1 = df.f(x+h);

 f2 = df.f(x-h);

 System.out.println("fd0 = " + fd0 +",fd1 = "+ fd1);

 } while(Math.abs(fd0 - fd1) > eps );

 return fd1;

 } // approx\_deriv

} //deriv

class x3100 implements DoubleFunction

{

 public double f( double x)

 {

 return (x\*x\*x - 100.0);

 } // fun

} // x3100

public class deriv3a

{

 static public double x3100Derivative( double x)

 {

 return (3\*x\*x);

 } // f

 public static void main(String[] args)

 {

 double x;

 x3100 tr100 = new x3100();

 deriv nt = new deriv();

 System.out.println("approx\_deriv(5.0) = " +

 nt.approx\_deriv(tr100, 5.0, 0.0000001));

 System.out.println("real\_deriv(5.0) = " +

 x3100Derivative(5.0));

 } // main

}// deriv3a

פלט ריצה:

fd0 = 81.25,fd1 = 76.5625

fd0 = 76.5625,fd1 = 75.390625

fd0 = 75.390625,fd1 = 75.09765625

fd0 = 75.09765625,fd1 = 75.0244140625

fd0 = 75.0244140625,fd1 = 75.006103515625

fd0 = 75.006103515625,fd1 = 75.00152587890625

fd0 = 75.00152587890625,fd1 = 75.00038146972656

fd0 = 75.00038146972656,fd1 = 75.00009536743164

fd0 = 75.00009536743164,fd1 = 75.00002384185791

fd0 = 75.00002384185791,fd1 = 75.00000596046448

fd0 = 75.00000596046448,fd1 = 75.00000149011612

fd0 = 75.00000149011612,fd1 = 75.00000037252903

fd0 = 75.00000037252903,fd1 = 75.00000009313226

fd0 = 75.00000009313226,fd1 = 75.00000002328306

approx\_deriv(5.0) = 75.00000002328306

real\_deriv(5.0) = 75.0