Step-by-step walkthrough for example on page 15 – 16 of the lecture notes: Revision Example, Pointer, Reference & const-ness

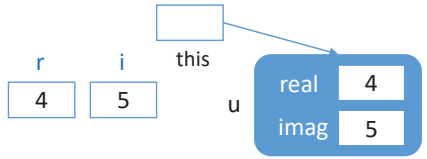
```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x) // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x) // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

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  public:
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    Complex add1(const Complex& x) // Return by value
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      real += x.real; imag += x.imag;
      return (*this);
    }
};
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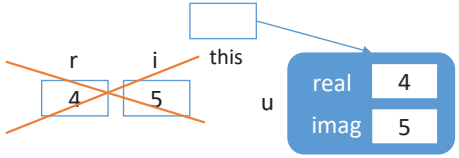


```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```


```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
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  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
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  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```
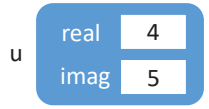
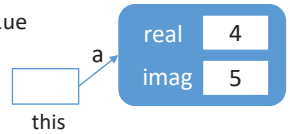



```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x) // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x) // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



Output

```
( 4 , 5 )
```

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
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  Complex u(4, 5); f(u); g(&u); h(u);
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  Complex w(10, 10); cout << endl << endl;
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  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
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  return 0;
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```

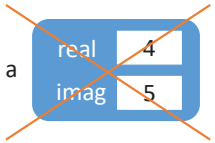


```
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#include "complex.h"

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  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```


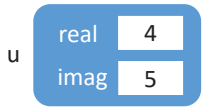


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#include "complex.h"

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void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
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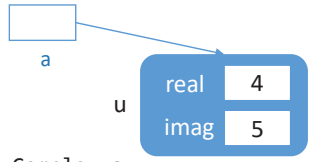
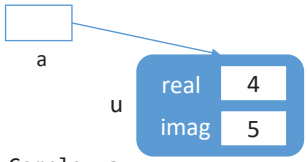
}
```


```
void g(const Complex* a) { a->print(); } // const Complex* a = &u
```

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  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

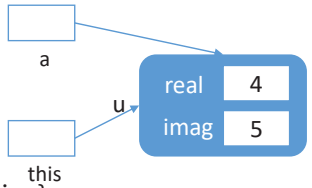


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class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
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      real += x.real; imag += x.imag;
      return (*this);
    }
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      return this;
    }
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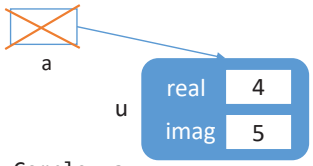
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
```

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  return 0;
}
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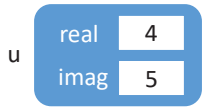


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}
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```
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    float real; float imag;
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      return this;
    }
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    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
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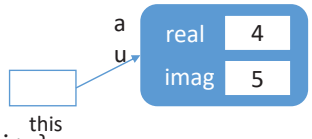

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```


```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
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  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
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  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```


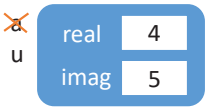

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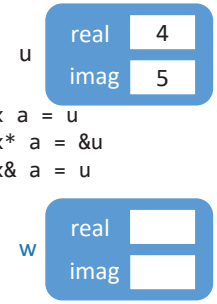
#include "complex.h"

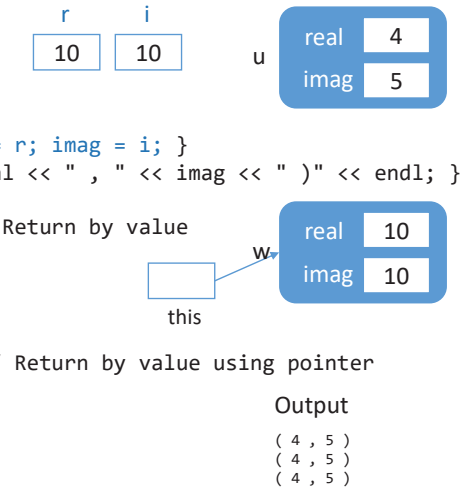
void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```



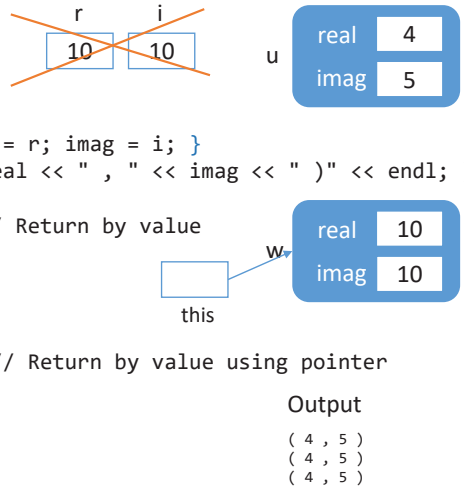

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x) // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x) // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

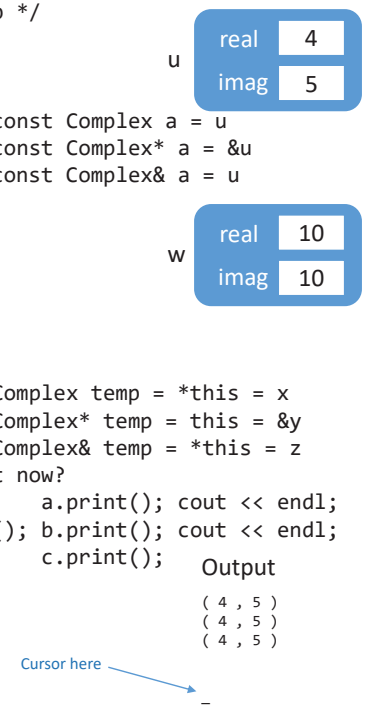
    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x) // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x) // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```



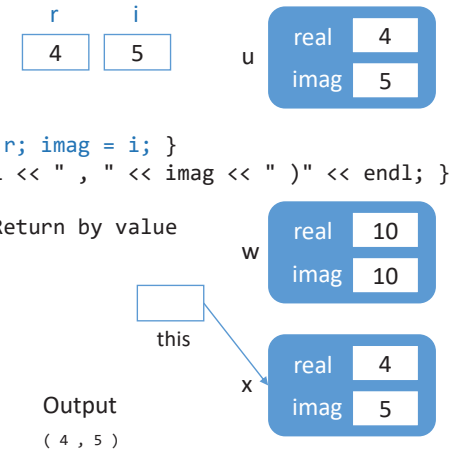
```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```


```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

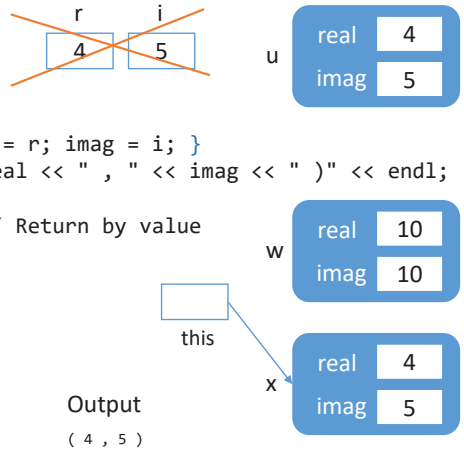


Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



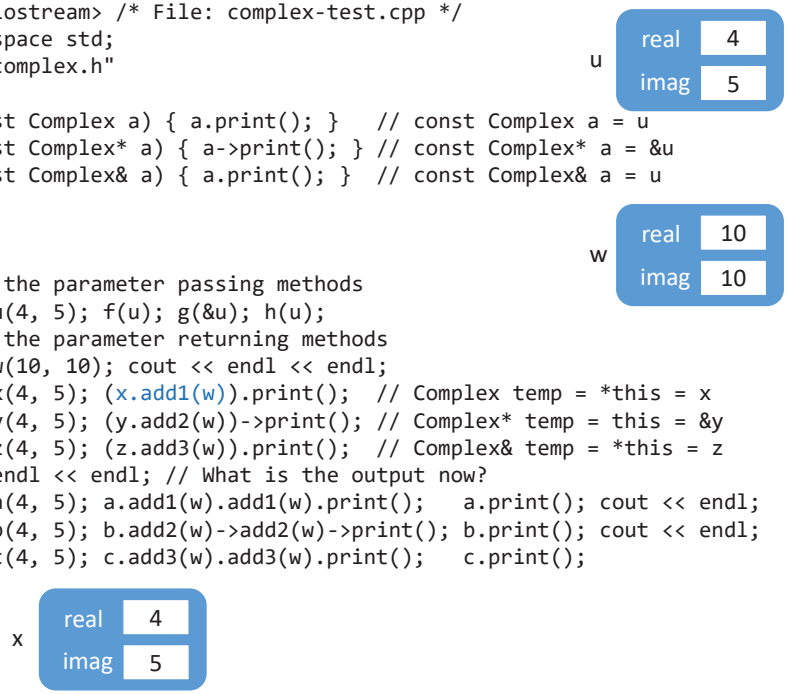
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

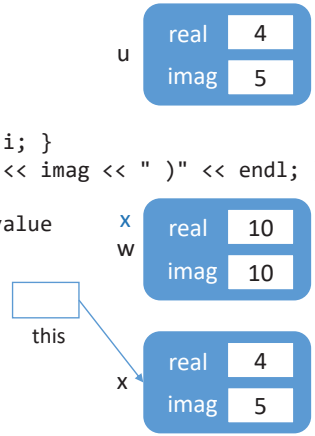
void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```



```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

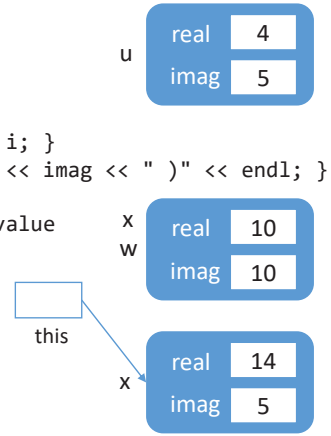


Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

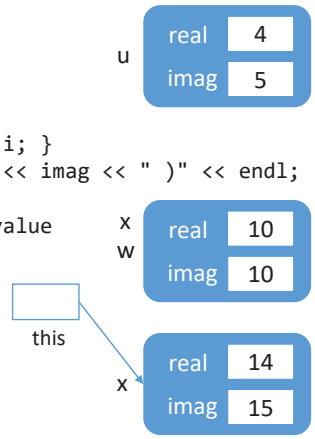


Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



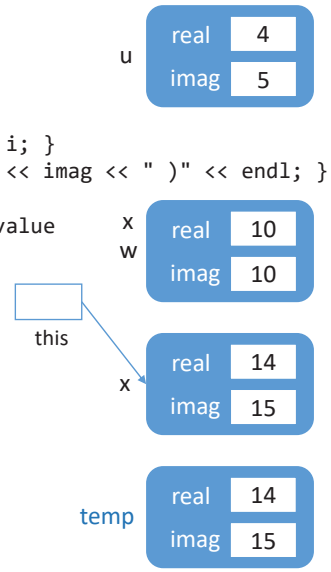
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

*this is x,
Returning it by value, we need to construct a temporary object "temp" which is a copy of x



Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )
```

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is temp

u: real 4, imag 5

w: real 10, imag 10

x: real 4, imag 5

temp: real 14, imag 15

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

u: real 4, imag 5

w: real 10, imag 10

x: real 14, imag 15

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
```

this

temp: real 14, imag 15

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is temp

u: real 4, imag 5

w: real 10, imag 10

x: real 14, imag 15

temp: ~~real 14, imag 15~~

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

u: real 4, imag 5

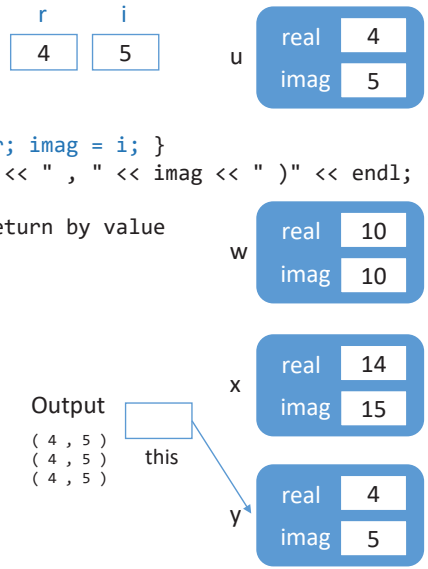
w: real 10, imag 10

x: real 14, imag 15

y: real, imag

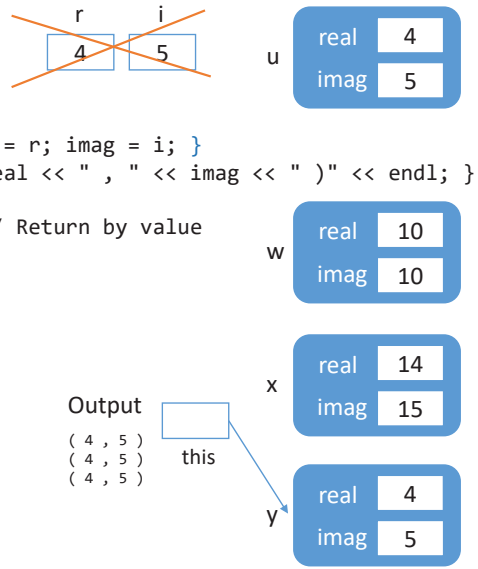
```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

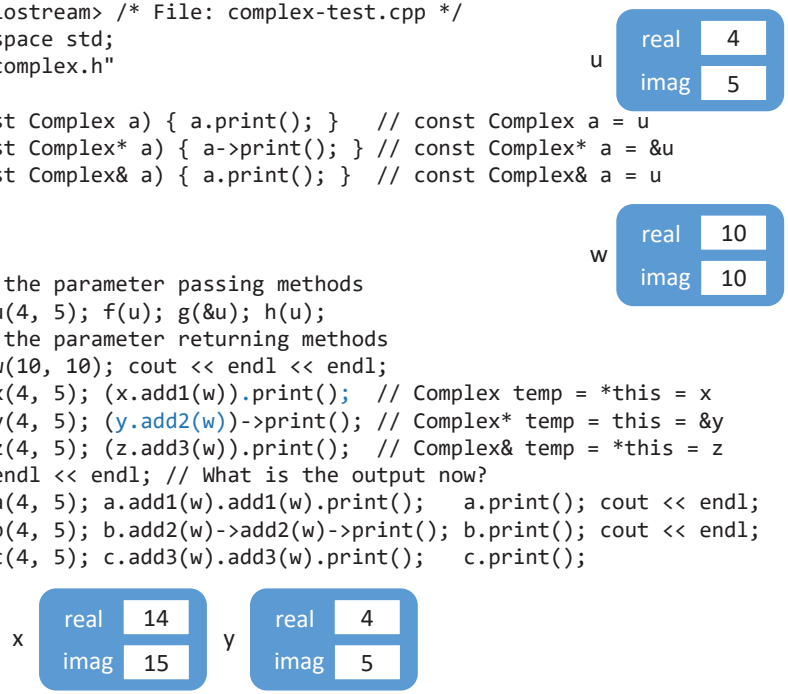
    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

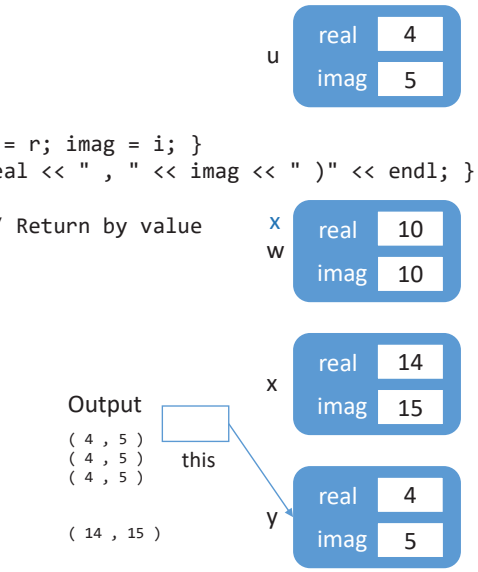
void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```



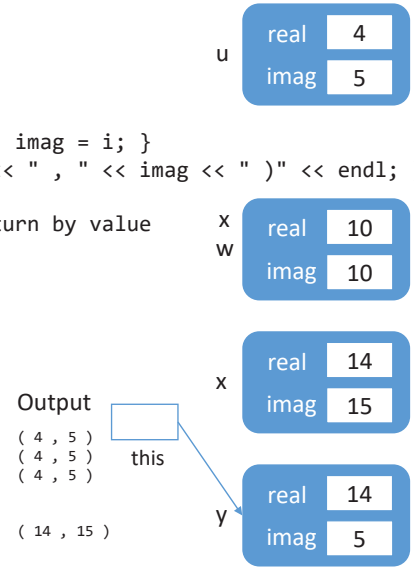

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



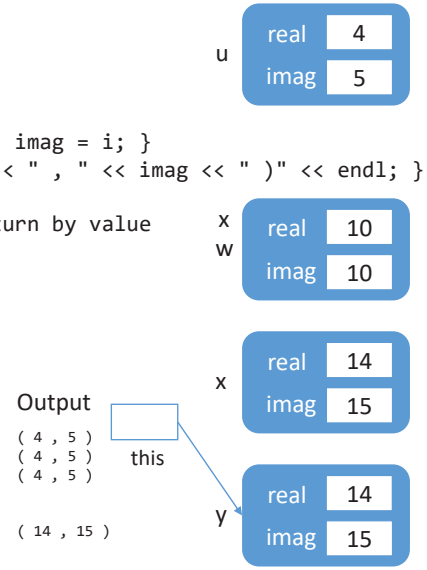
```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



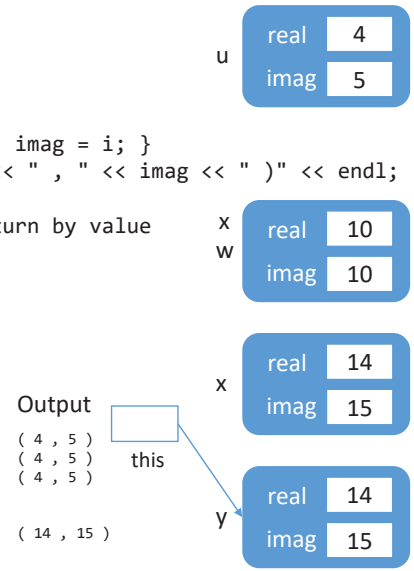

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

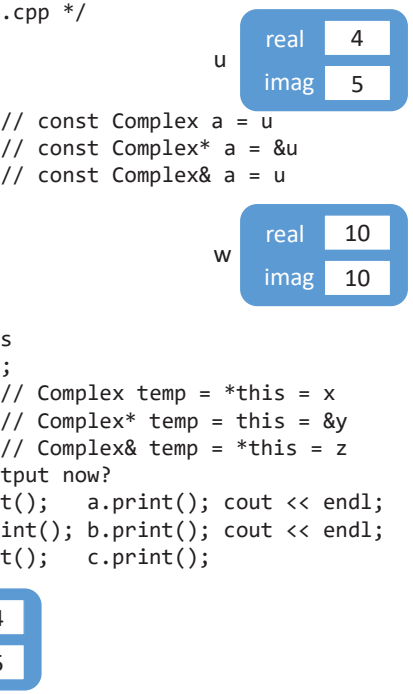



```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

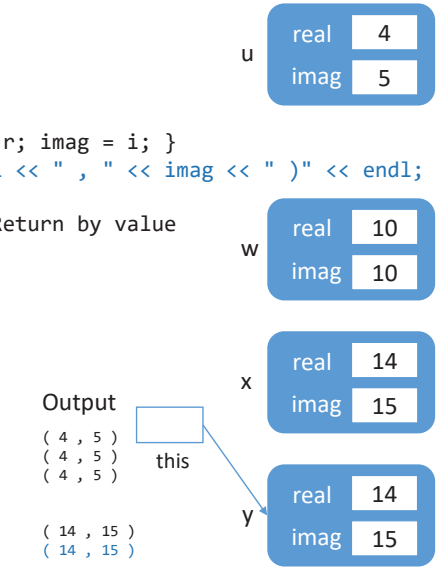
int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is &y, i.e. address of y



```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

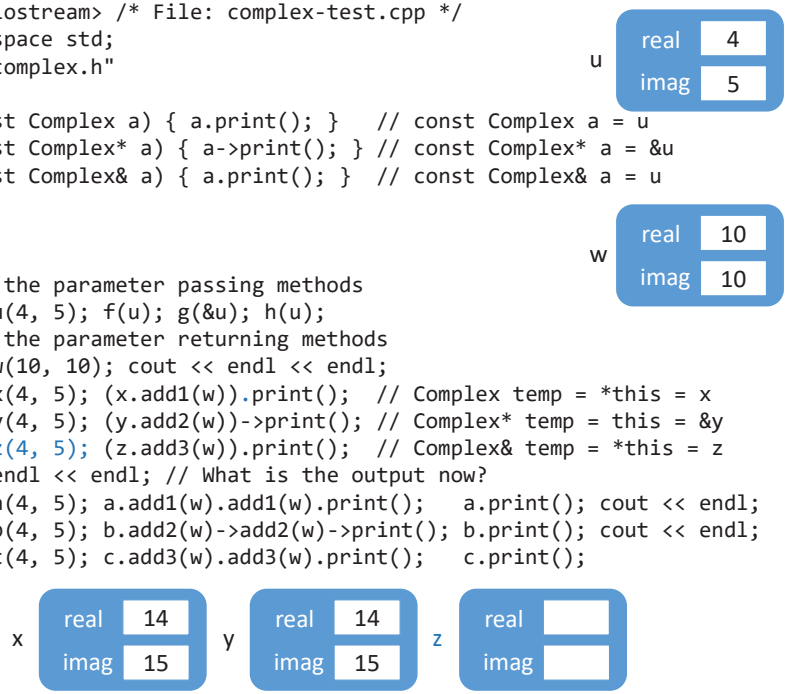
    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

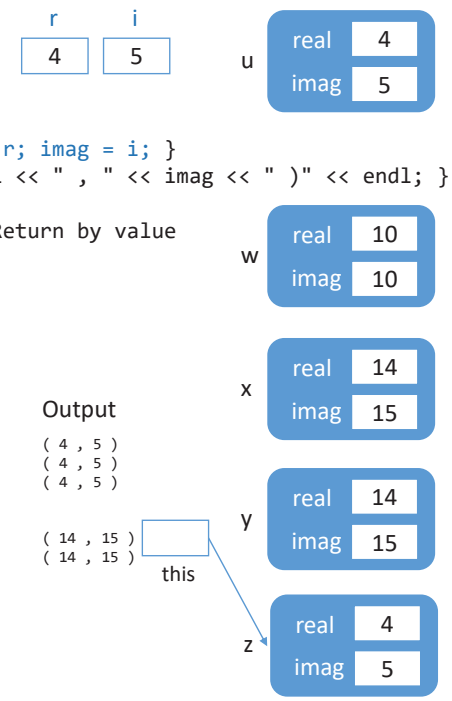
void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```




```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```




```
class Complex /* File: complex.h */
{
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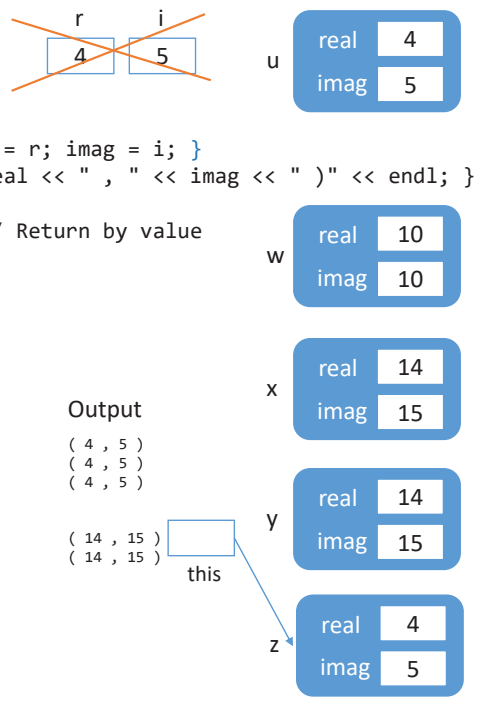
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
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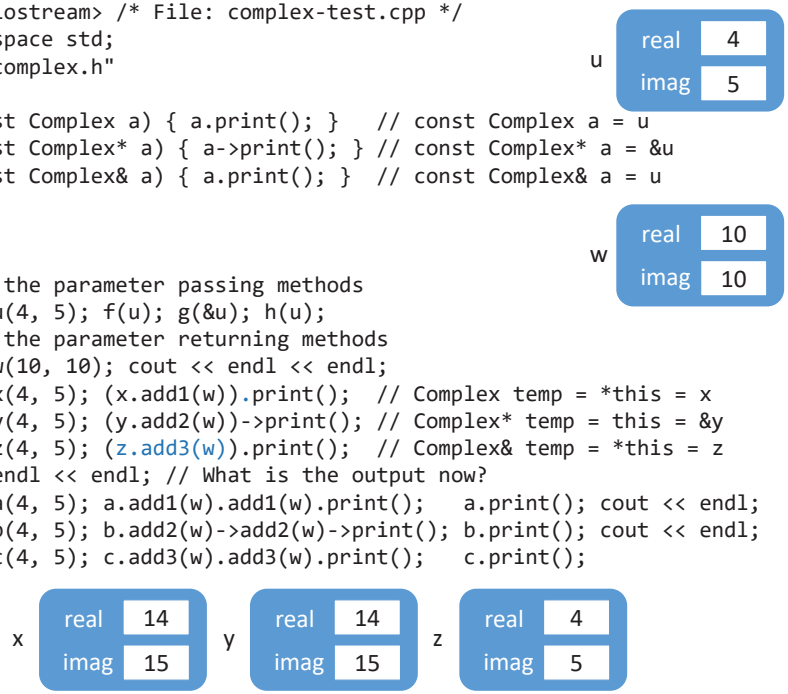
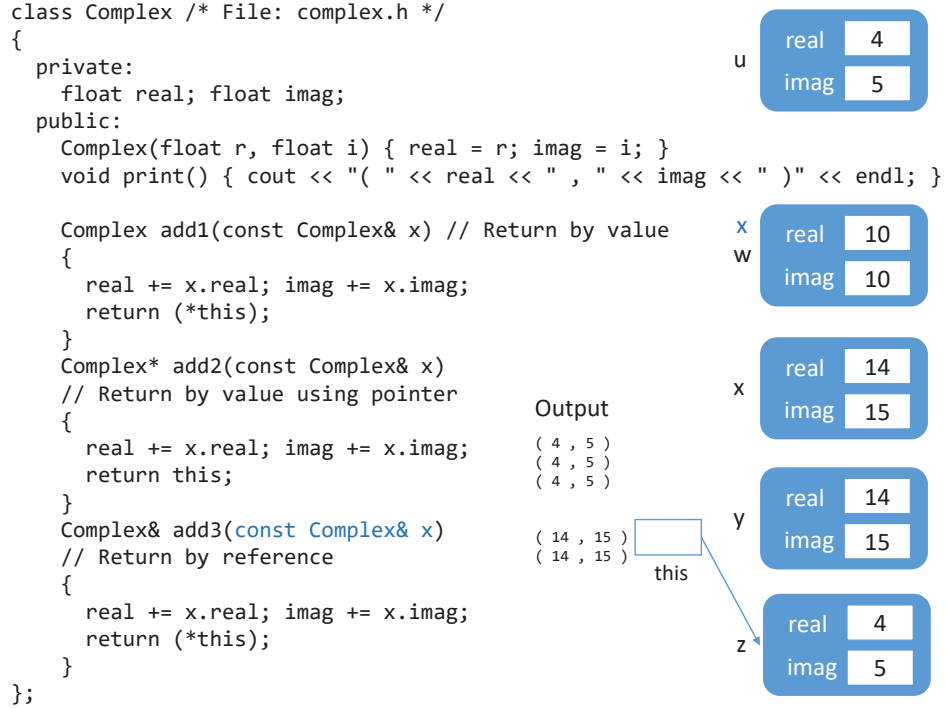
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```




```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

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  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
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      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```
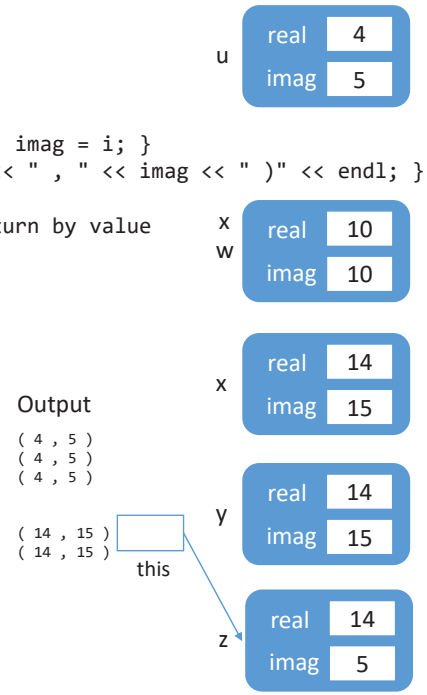
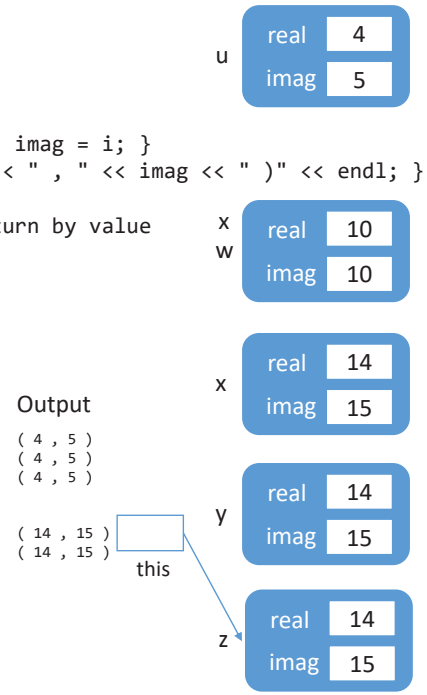




```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



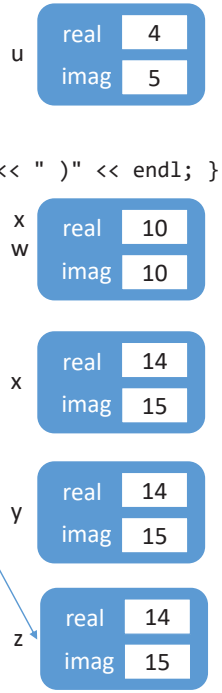
```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

*this is z,
Returning it by reference, i.e. returning z

Output

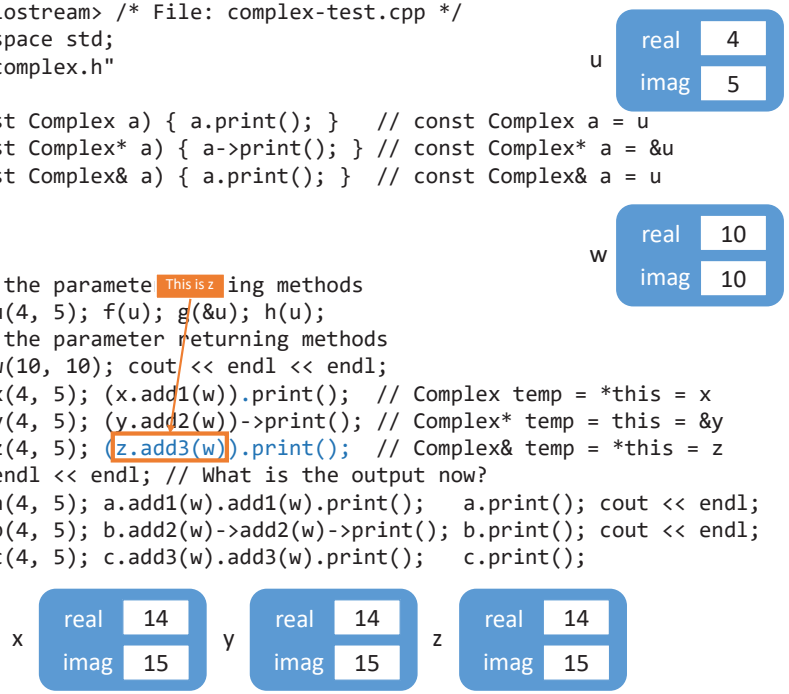
```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```

this




```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }   // const Complex a = u
void g(const Complex* a) { a->print(); } // const Complex* a = &u
void h(const Complex& a) { a.print(); }  // const Complex& a = u

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is z

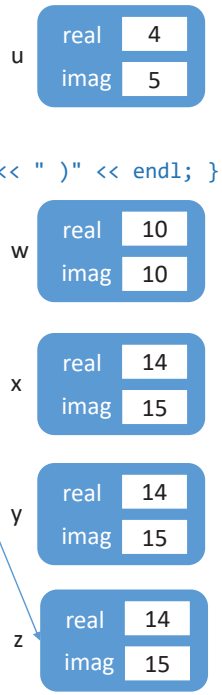



```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

this

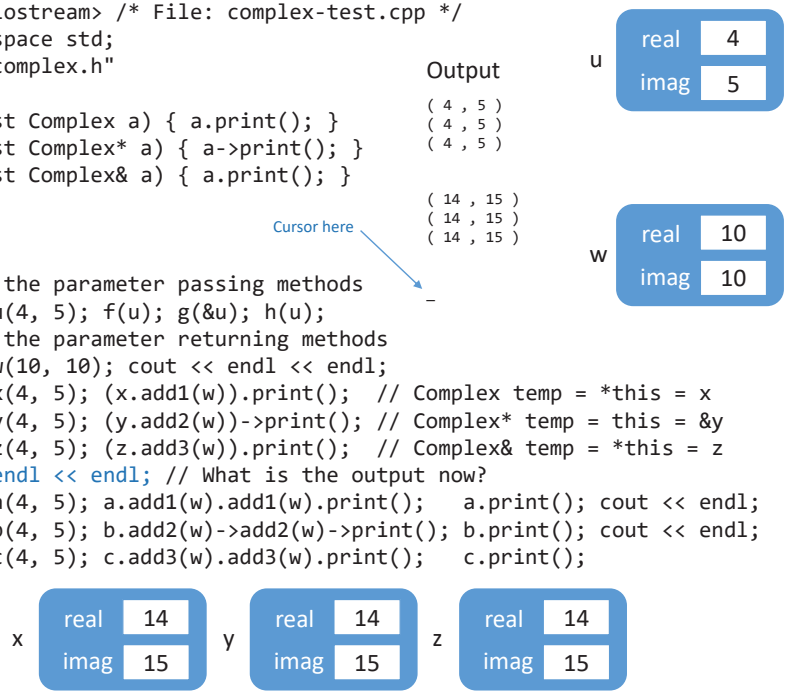



```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

Cursor here



u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

As the objects u, x, y and z are not used in the remaining code, their corresponding boxes are not drawn from now.

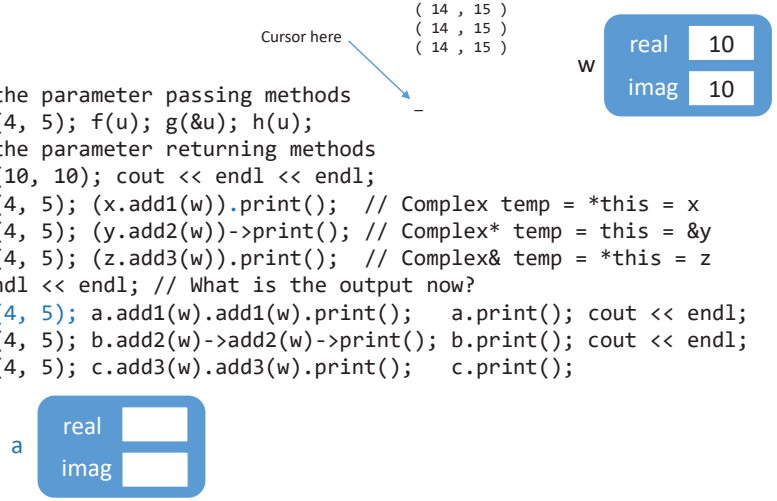
u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

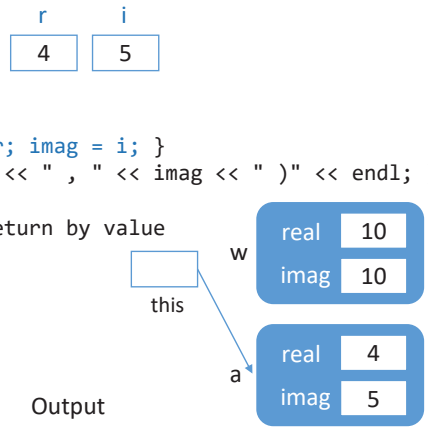
```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

Cursor here



u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

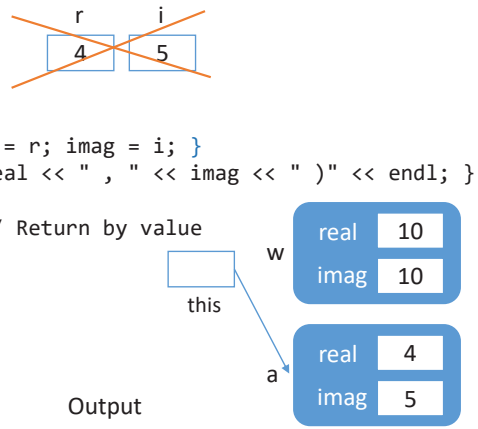


Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

w: real 10, imag 10

a: real 4, imag 5

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

x: real 10, imag 10

w: real 10, imag 10

this

a: real 4, imag 5

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

x: real 10, imag 10

w: real 10, imag 10

this

a: real 14, imag 5

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

x: real 10, imag 10

w: real 10, imag 10

this

a: real 14, imag 15

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```

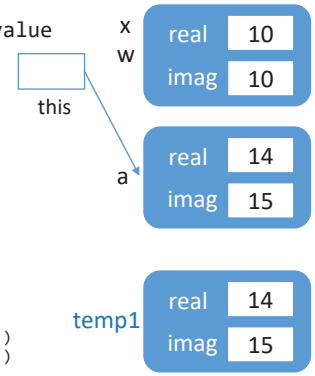
u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

*this is a,
Returning it by value, we need to construct a temporary object "temp1" which is a copy of a

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```



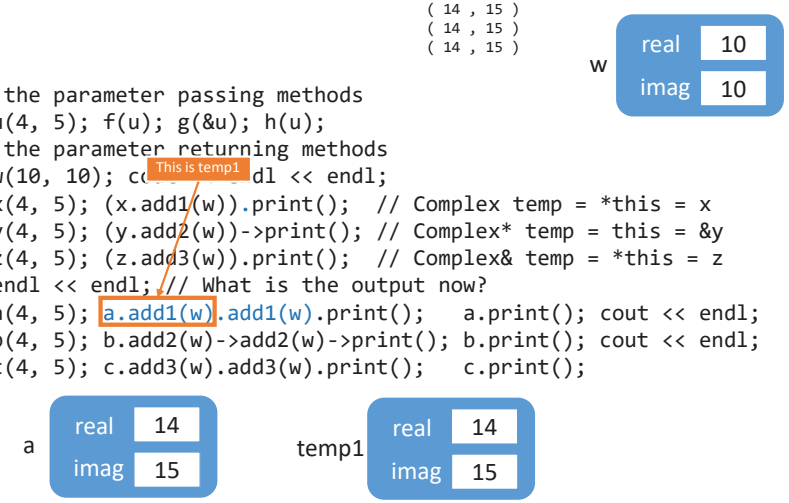
u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); c[illegible]dl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is temp1

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

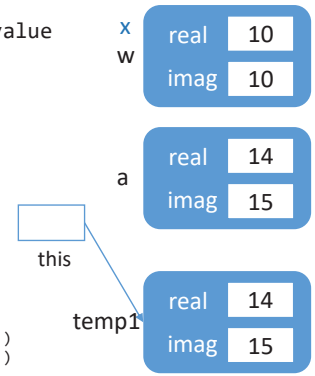


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```

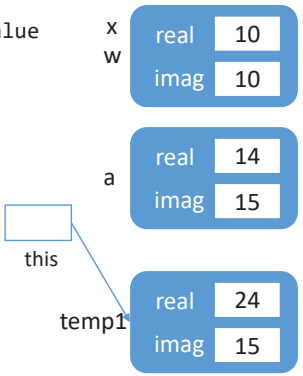


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```

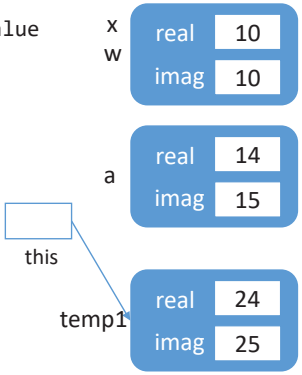


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```



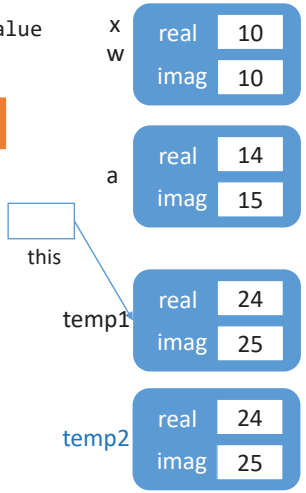
u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

*this is temp1,
Returning it by value, we need to construct a temporary object "temp2" which is a copy of temp1

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
```



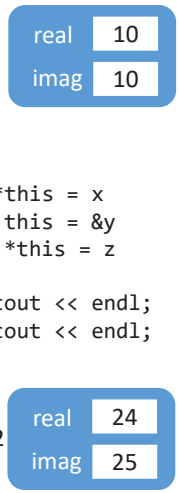
u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); co[illegible]dl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is temp2

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )
```

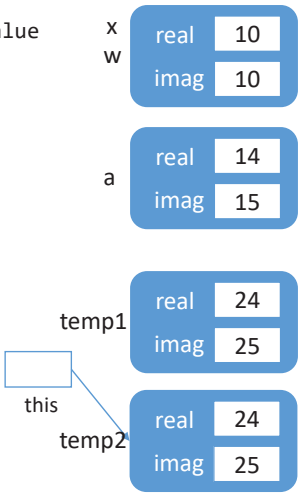


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
```



u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, This is temp1 t << This is temp2 endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
```

w: real 10, imag 10

a: real 14, imag 15

temp1: ~~real 24, imag 25~~

temp2: ~~real 24, imag 25~~

u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
```

w: real 10, imag 10

a: real 14, imag 15

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

w: real 10, imag 10

this

a: real 14, imag 15

u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Cursor here

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

w: real 10, imag 10

a: real 14, imag 15

u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

w: real 10, imag 10

a: real 14, imag 15

b: real, imag

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

r: 4, i: 5

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

this

w: real 10, imag 10

a: real 14, imag 15

b: real 4, imag 5

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

r: 4, i: 5

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

this

w: real 10, imag 10

a: real 14, imag 15

b: real 4, imag 5

u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

w: real 10, imag 10

a: real 14, imag 15

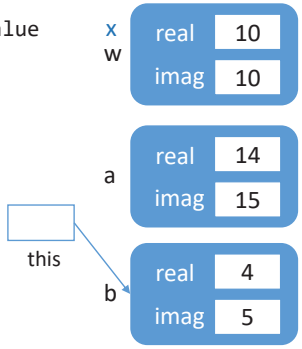
b: real 4, imag 5

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

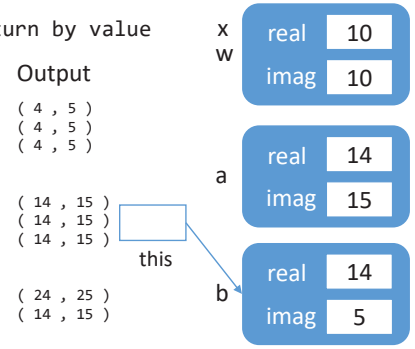


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

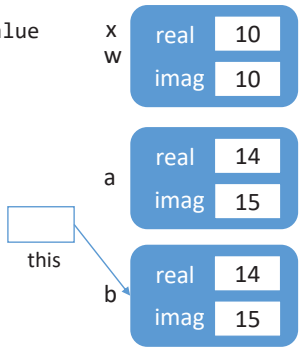


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

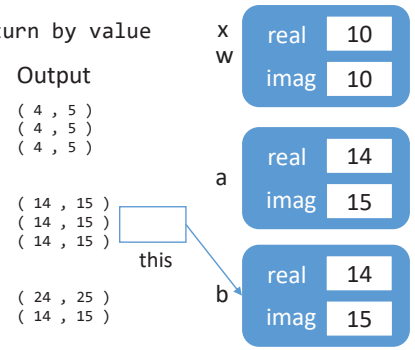


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```



u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); c[This is &b, i.e. address of b]ndl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

w: real 10, imag 10

a: real 14, imag 15

b: real 14, imag 15

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

this

x, w: real 10, imag 10

a: real 14, imag 15

b: real 14, imag 15

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

this

x, w: real 10, imag 10

a: real 14, imag 15

b: real 24, imag 15

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

this

x, w: real 10, imag 10

a: real 14, imag 15

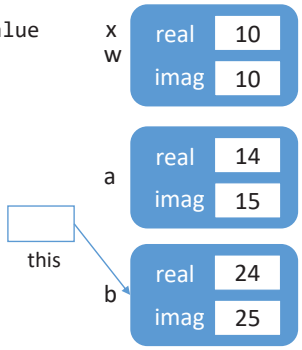
b: real 24, imag 25

u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

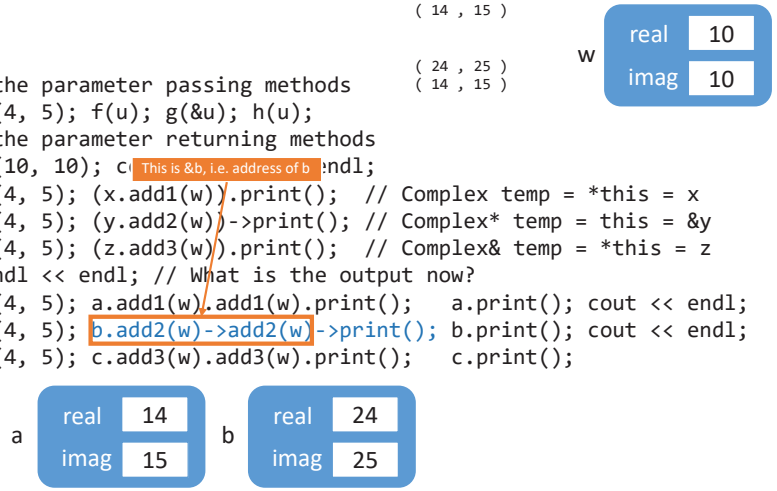


u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); c[This is &b, i.e. address of b]endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )
```

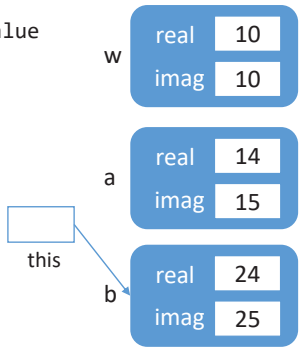


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
```

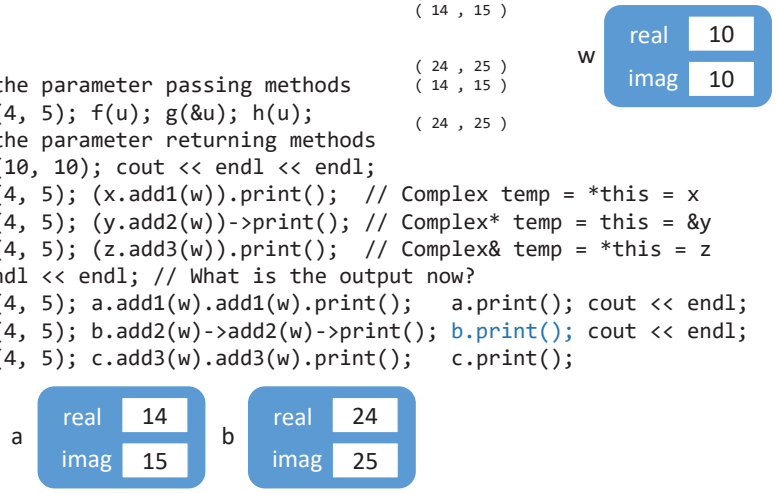


u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
```

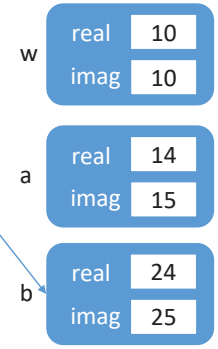


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



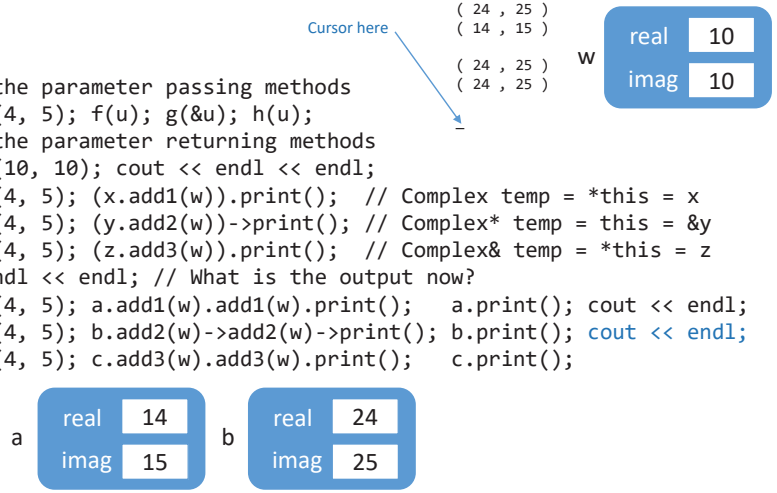
u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

Cursor here

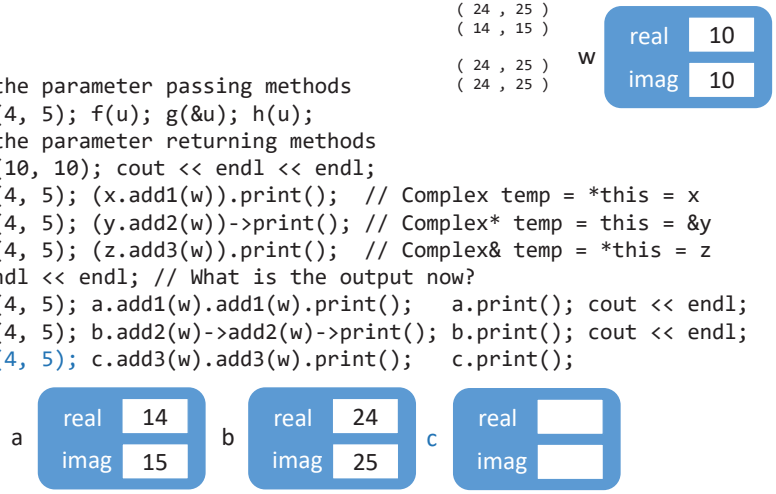


u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

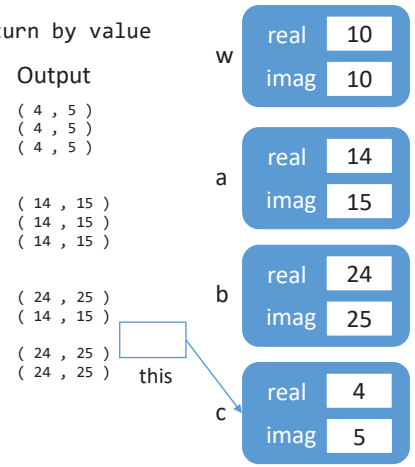


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

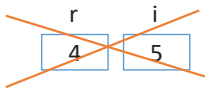
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



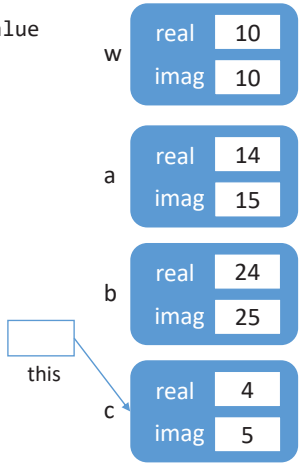
u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```



Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

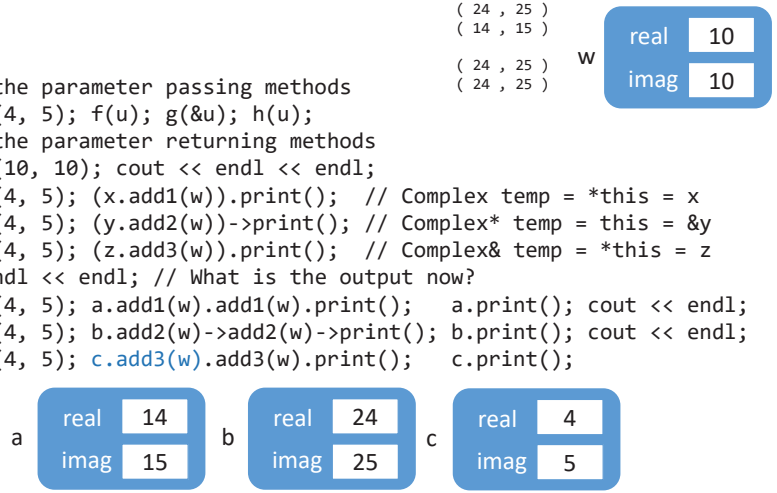


u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

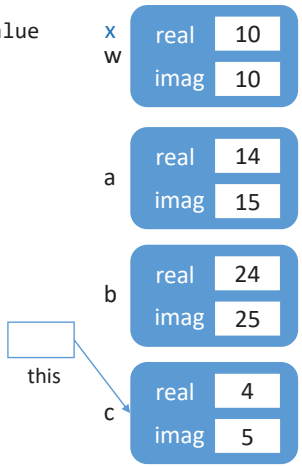


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

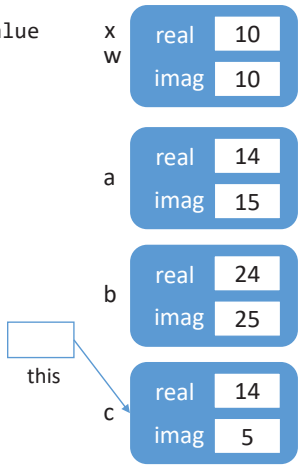


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

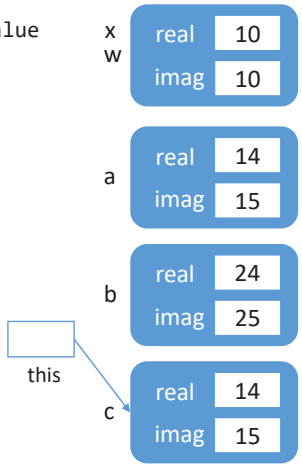


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



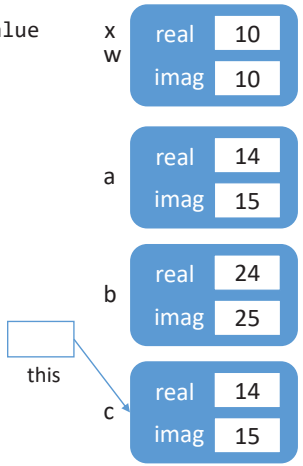
u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

*this is c,
Returning it by reference, i.e. returning c

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



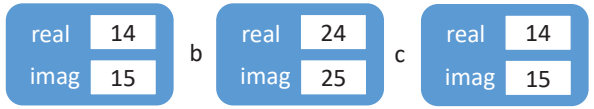
u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is c

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```

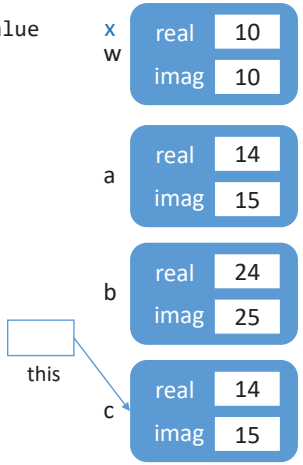


u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

```
class Complex /* File: complex.h */
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  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
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      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

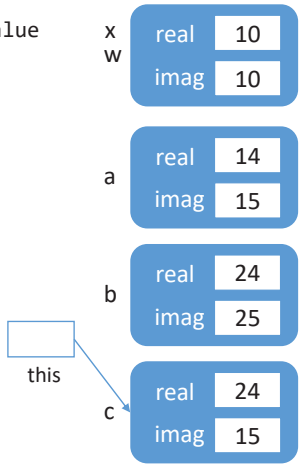
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

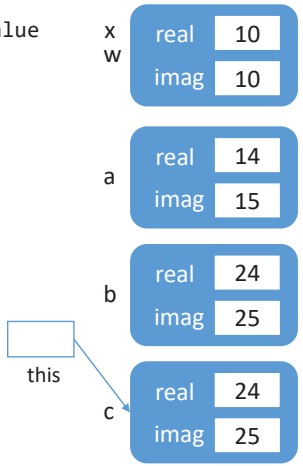
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

*this is c,
Returning it by reference, i.e. returning c

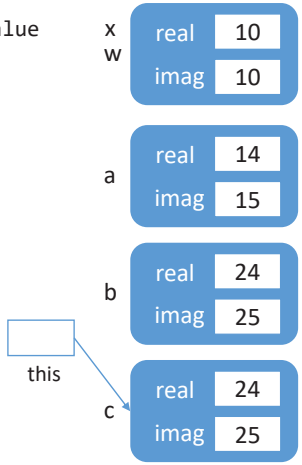
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

This is c

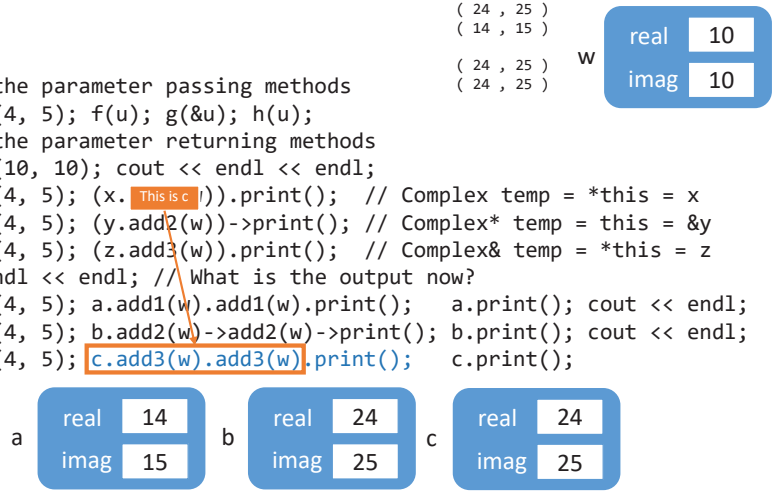
Output

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

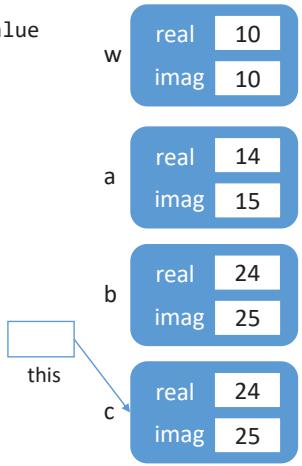
```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
```



u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

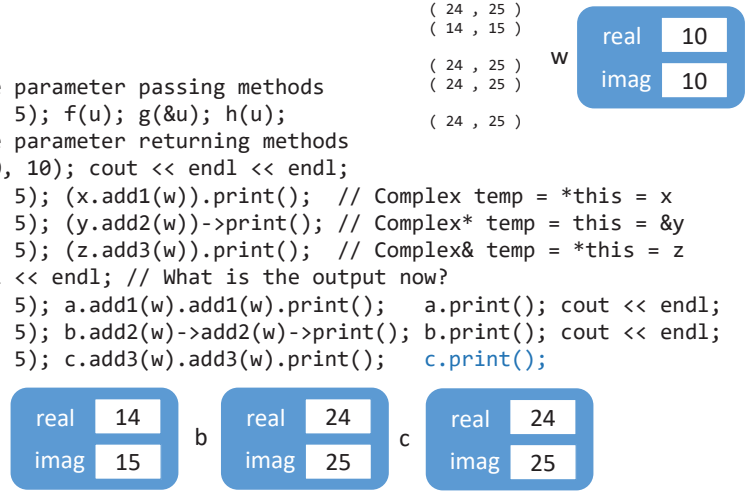
```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
```



u x y z

```
class Complex /* File: complex.h */
{
  private:
    float real; float imag;
  public:
    Complex(float r, float i) { real = r; imag = i; }
    void print() { cout << "( " << real << " , " << imag << " )" << endl; }

    Complex add1(const Complex& x) // Return by value
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
    Complex* add2(const Complex& x)
    // Return by value using pointer
    {
      real += x.real; imag += x.imag;
      return this;
    }
    Complex& add3(const Complex& x)
    // Return by reference
    {
      real += x.real; imag += x.imag;
      return (*this);
    }
};
```

Output

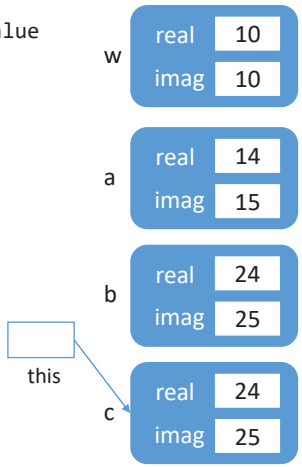
```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

Output

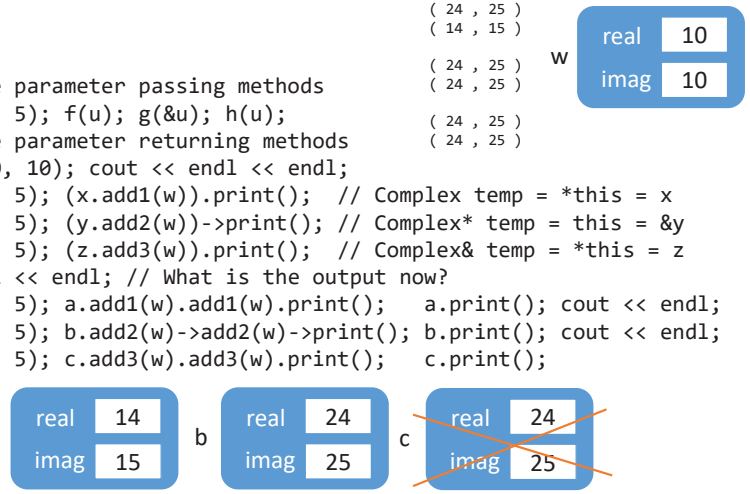
```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```



u x y z

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

w: real 10, imag 10

a: real 14, imag 15

b: ~~real 24, imag 25~~

u x y z

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
  Complex y(4, 5); (y.add2(w))->print(); // Complex* temp = this = &y
  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

w: real 10, imag 10

a: ~~real 14, imag 15~~

u x y ~~z~~

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
  // Check the parameter returning methods
  Complex w(10, 10); cout << endl << endl;
  Complex x(4, 5); (x.add1(w)).print();  // Complex temp = *this = x
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  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
```

```
( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

w: real 10, imag 10

u x ~~y~~

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
void h(const Complex& a) { a.print(); }

int main()
{
  // Check the parameter passing methods
  Complex u(4, 5); f(u); g(&u); h(u);
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  Complex z(4, 5); (z.add3(w)).print();  // Complex& temp = *this = z
  cout << endl << endl; // What is the output now?
  Complex a(4, 5); a.add1(w).add1(w).print();   a.print(); cout << endl;
  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
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  return 0;
}
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( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

w: real 10, imag 10

u ✗

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
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void h(const Complex& a) { a.print(); }

int main()
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  // Check the parameter passing methods
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( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

w

real	10
imag	10

u

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
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}
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( 4 , 5 )
( 4 , 5 )
( 4 , 5 )

( 14 , 15 )
( 14 , 15 )
( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

w

~~real~~	~~10~~
~~imag~~	~~10~~

Output

```
#include <iostream> /* File: complex-test.cpp */
using namespace std;
#include "complex.h"

void f(const Complex a) { a.print(); }
void g(const Complex* a) { a->print(); }
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( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

Output

```
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  Complex b(4, 5); b.add2(w)->add2(w)->print(); b.print(); cout << endl;
  Complex c(4, 5); c.add3(w).add3(w).print();   c.print();
  return 0;
}
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( 14 , 15 )
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( 14 , 15 )

( 24 , 25 )
( 14 , 15 )

( 24 , 25 )
( 24 , 25 )

( 24 , 25 )
( 24 , 25 )
```

Done!!! :)