

## PRACTICAL - 2

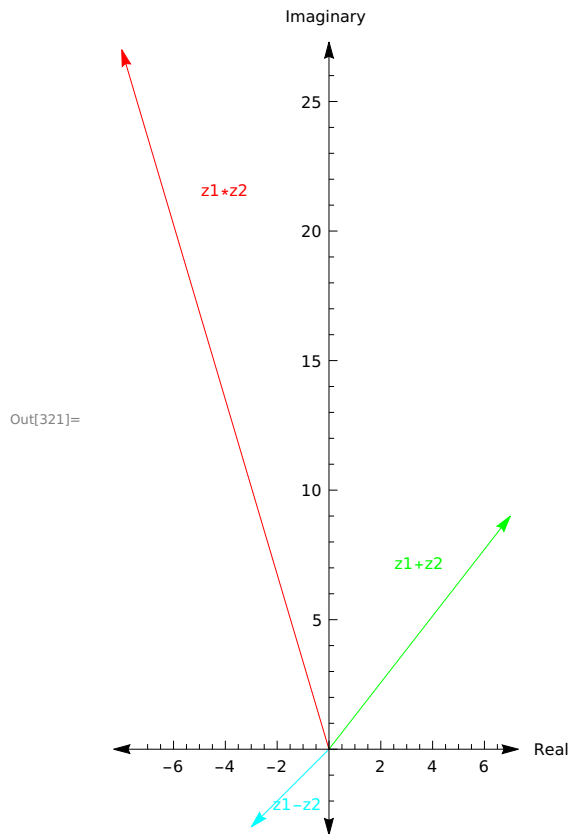
### DISCUSS THE ALGEBRA OF COMPLEX NUMBERS

QUES:FIND  $Z_1+Z_2$ ,  $Z_1-Z_2$ ,  $Z_1*Z_2$  AND  $Z_1/Z_2$  FOR THE FOLLOWING:

1)  $2+3i$  and  $5+6i$

```
In[312]:= z1 = 2 + 3 I
z2 = 5 + 6 I
Print["z1+z2 = ", z1 + z2]
Print["z1-z2 = ", z1 - z2]
Print["z1*z2 = ", z1 * z2]
Print["z1/z2 = ", z1 / z2]
a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
  Text["z1+z2", {Re[z1 + z2] / 2, 0.8 Im[z1 + z2]}], Axes -> True,
  AxesStyle -> Arrowheads[{-0.04, 0.04}], AxesLabel -> {Real, Imaginary}];
b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
  Text["z1-z2", {0.4 Re[z1 - z2], 0.7 Im[z1 - z2]}],
  Axes -> True, AxesStyle -> Arrowheads[{-0.04, 0.04}]];
c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
  Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
  Axes -> True, AxesStyle -> Arrowheads[{-0.04, 0.04}]];
Show[
  a,
  b,
  c]
Out[312]= 2 + 3 i
Out[313]= 5 + 6 i

z1+z2 = 7 + 9 i
z1-z2 = -3 - 3 i
z1*z2 = -8 + 27 i
z1/z2 =  $\frac{28}{61} + \frac{3i}{61}$ 
```



2)  $3+4i$  and  $4-7i$

```

In[322]:= z1 = 3 + 4 I
          z2 = 4 - 7 I
          Print["z1+z2 = ", z1 + z2]
          Print["z1-z2 = ", z1 - z2]
          Print["z1*z2 = ", z1 * z2]
          Print["z1/z2 = ", z1 / z2]
          a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
            Text["z1+z2", {Re[z1 + z2] / 2, 0.8 Im[z1 + z2]}], Axes → True,
            AxesStyle → Arrowheads[{-0.04, 0.04}], AxesLabel → {Real, Imaginary}};
          b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
            Text["z1-z2", {2.5 Re[z1 - z2], 0.6 Im[z1 - z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
            Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          Show[
            a,
            b,
            c]

```

Out[322]=  $3 + 4 i$

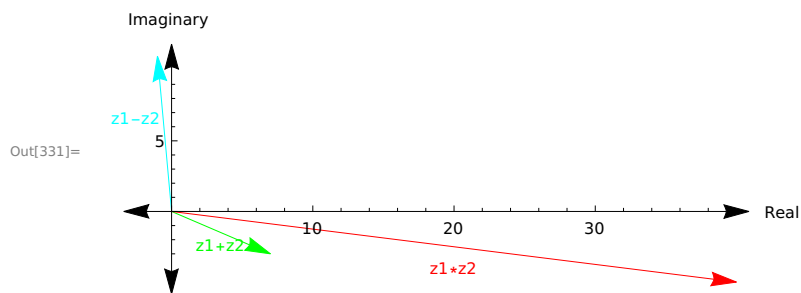
Out[323]=  $4 - 7 i$

$$z1+z2 = 7 - 3 i$$

$$z1-z2 = -1 + 11 i$$

$$z1*z2 = 40 - 5 i$$

$$z1/z2 = -\frac{16}{65} + \frac{37 i}{65}$$



3)  $6+11 i$  and  $2-5 i$

```

In[352]:= z1 = 6 + 11 I
z2 = 2 - 5 I
Print["z1+z2 = ", z1 + z2]
Print["z1-z2 = ", z1 - z2]
Print["z1*z2 = ", z1 * z2]
Print["z1/z2 = ", z1 / z2]
a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
  Text["z1+z2", {1.5 Re[z1 + z2], 0.8 Im[z1 + z2]}], Axes → True,
  AxesStyle → Arrowheads[{-0.04, 0.04}], AxesLabel → {Real, Imaginary}];
b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
  Text["z1-z2", {2 Re[z1 - z2], 0.6 Im[z1 - z2]}],
  Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
  Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
  Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
Show[
  a,
  b,
  c]

```

Out[352]=  $6 + 11 i$

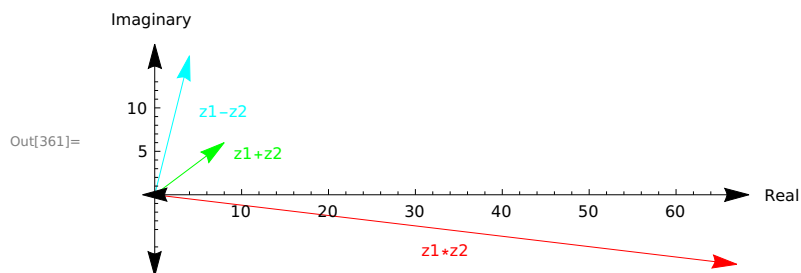
Out[353]=  $2 - 5 i$

$$z1+z2 = 8 + 6 i$$

$$z1-z2 = 4 + 16 i$$

$$z1*z2 = 67 - 8 i$$

$$z1/z2 = -\frac{43}{29} + \frac{52 i}{29}$$



4)  $-1-i$  and  $4+i$

```

In[362]:= z1 = -1 - I
          z2 = 4 + I
          Print["z1+z2 = ", z1 + z2]
          Print["z1-z2 = ", z1 - z2]
          Print["z1*z2 = ", z1 * z2]
          Print["z1/z2 = ", z1 / z2]
          a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
            Text["z1+z2", {Re[z1 + z2] / 2, 0.8 Im[z1 + z2]}], Axes → True,
            AxesStyle → Arrowheads[{-0.04, 0.04}], AxesLabel → {Real, Imaginary}};
          b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
            Text["z1-z2", {0.4 Re[z1 - z2], 0.6 Im[z1 - z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
            Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          Show[
            a,
            b,
            c]

```

Out[362]=  $-1 - i$

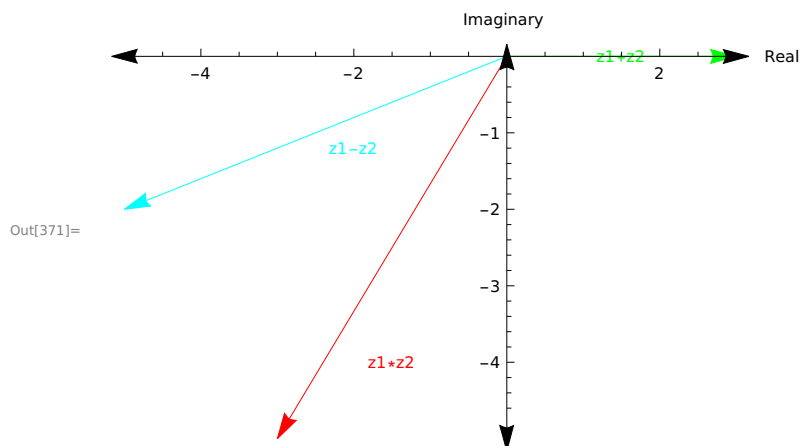
Out[363]=  $4 + i$

$$z1+z2 = 3$$

$$z1-z2 = -5 - 2i$$

$$z1*z2 = -3 - 5i$$

$$z1/z2 = -\frac{5}{17} - \frac{3i}{17}$$



5)  $1+2i$  and  $3-4i$

```

In[372]:= z1 = 1 + 2 I
z2 = 3 - 4 I
Print["z1+z2 = ", z1 + z2]
Print["z1-z2 = ", z1 - z2]
Print["z1*z2 = ", z1 * z2]
Print["z1/z2 = ", z1 / z2]
a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
  Text["z1+z2", {Re[z1 + z2] / 2, 0.8 Im[z1 + z2]}], Axes → True,
  AxesStyle → Arrowheads[{-0.04, 0.04}], AxesLabel → {Real, Imaginary}];
b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
  Text["z1-z2", {0.3 Re[z1 - z2], 0.6 Im[z1 - z2]}],
  Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
  Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
  Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
Show[
  a,
  b,
  c]

```

Out[372]=  $1 + 2i$

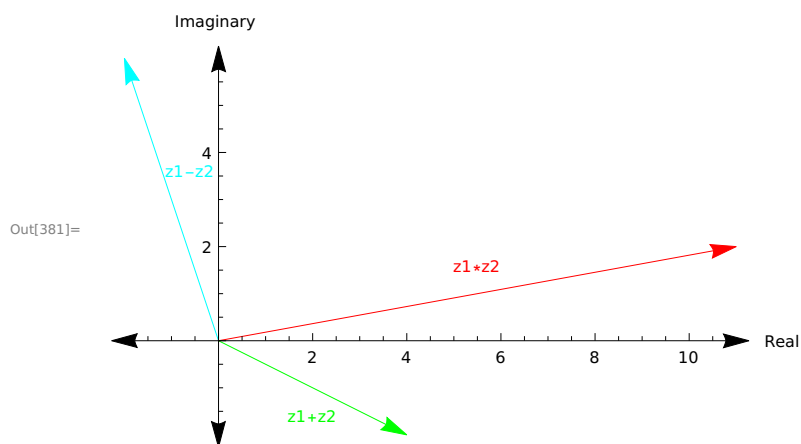
Out[373]=  $3 - 4i$

$$z1+z2 = 4 - 2i$$

$$z1-z2 = -2 + 6i$$

$$z1*z2 = 11 + 2i$$

$$z1/z2 = -\frac{1}{5} + \frac{2i}{5}$$



6)  $-8+2i$  and  $9+i$

```

In[432]:= z1 = -8 + 2 I
z2 = 9 + I
Print["z1+z2 = ", z1 + z2]
Print["z1-z2 = ", z1 - z2]
Print["z1*z2 = ", z1 * z2]
Print["z1/z2 = ", z1 / z2]
a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
  Text["z1+z2", {4 Re[z1 + z2], 0.8 Im[z1 + z2]}], Axes → True,
  AxesStyle → Arrowheads[{-0.04, 0.04}], AxesLabel → {Real, Imaginary}};
b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
  Text["z1-z2", {0.2 Re[z1 - z2], -2 Im[z1 - z2]}],
  Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
  Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
  Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
Show[
  a,
  b,
  c]

```

Out[432]=  $-8 + 2i$

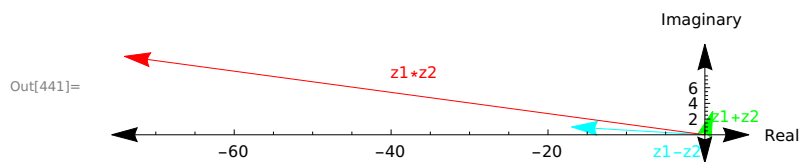
Out[433]=  $9 + i$

$$z1+z2 = 1 + 3i$$

$$z1-z2 = -17 + i$$

$$z1*z2 = -74 + 10i$$

$$z1/z2 = -\frac{35}{41} + \frac{13i}{41}$$



7)  $8i$  and  $1+0i$

```

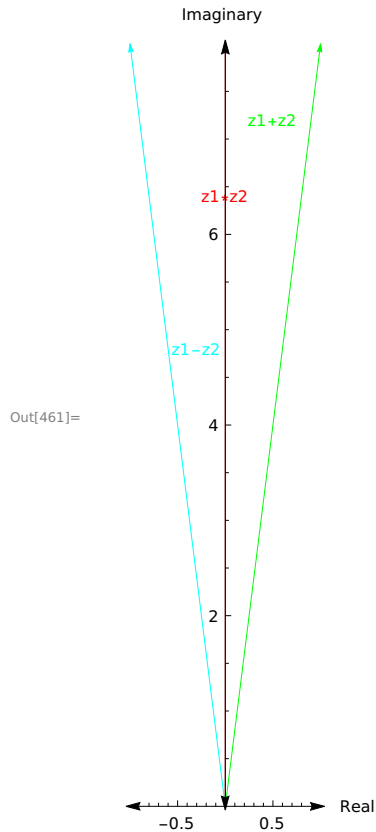
In[452]:= z1 = 8 I
          z2 = 1 + 0 I
          Print["z1+z2 = ", z1 + z2]
          Print["z1-z2 = ", z1 - z2]
          Print["z1*z2 = ", z1 * z2]
          Print["z1/z2 = ", z1 / z2]
          a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
            Text["z1+z2", {Re[z1 + z2] / 2, 0.9 Im[z1 + z2]}], Axes → True,
            AxesStyle → Arrowheads[{-0.07, 0.07}], AxesLabel → {Real, Imaginary}}];
          b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
            Text["z1-z2", {0.3 Re[z1 - z2], 0.6 Im[z1 - z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
            Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          Show[
            a,
            b,
            c]
Out[452]= 8 i

Out[453]= 1

z1+z2 = 1 + 8 i
z1-z2 = -1 + 8 i
z1*z2 = 8 i
z1/z2 = 8 i

```





8)  $7+19i$  and  $3+6i$

```
In[472]:= z1 = 7 + 19 I
z2 = 3 + 6 I
Print["z1+z2 = ", z1 + z2]
Print["z1-z2 = ", z1 - z2]
Print["z1*z2 = ", z1 * z2]
Print["z1/z2 = ", z1 / z2]
a = Graphics[{Green, Arrow[{{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
  Text["z1+z2", {1.5 Re[z1 + z2], 0.8 Im[z1 + z2]}], Axes -> True,
  AxesStyle -> Arrowheads[{-0.04, 0.04}], AxesLabel -> {Real, Imaginary}}];
b = Graphics[{Cyan, Arrow[{{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
  Text["z1-z2", {2.2 Re[z1 - z2], 0.6 Im[z1 - z2]}],
  Axes -> True, AxesStyle -> Arrowheads[{-0.04, 0.04}]];
c = Graphics[{Red, Arrow[{{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
  Text["z1*z2", {0.9 Re[z1 * z2], 0.8 Im[z1 * z2]}],
  Axes -> True, AxesStyle -> Arrowheads[{-0.04, 0.04}]];
Show[
  a,
  b,
  c]
```

Out[472]=  $7 + 19i$

Out[473]=  $3 + 6i$

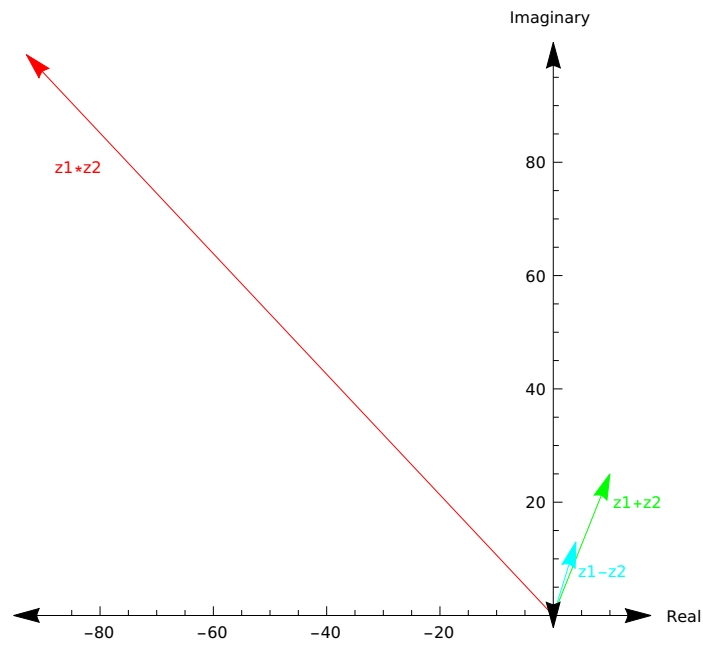
$$z_1 + z_2 = 10 + 25i$$

$$z_1 - z_2 = 4 + 13i$$

$$z_1 * z_2 = -93 + 99i$$

$$z_1 / z_2 = 3 + \frac{i}{3}$$

Out[481]=



9)  $1+i$  and  $2+2i$

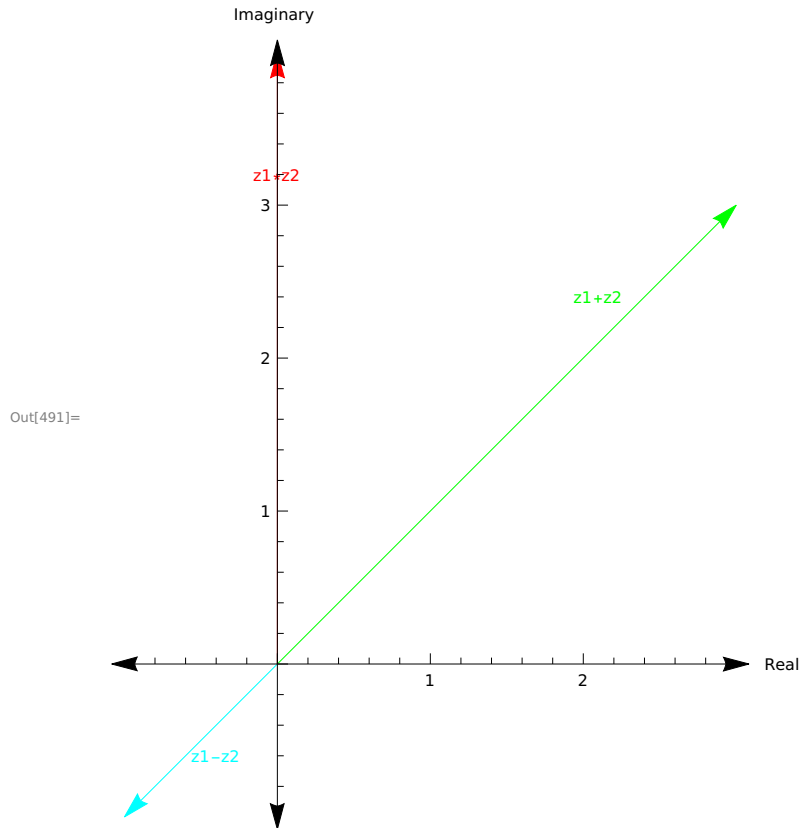
```

In[482]:= z1 = 1 + I
          z2 = 2 + 2 I
          Print["z1+z2 = ", z1 + z2]
          Print["z1-z2 = ", z1 - z2]
          Print["z1*z2 = ", z1 * z2]
          Print["z1/z2 = ", z1 / z2]
          a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
            Text["z1+z2", {0.7 Re[z1 + z2], 0.8 Im[z1 + z2]}], Axes → True,
            AxesStyle → Arrowheads[{-0.04, 0.04}], AxesLabel → {Real, Imaginary}};
          b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
            Text["z1-z2", {0.4 Re[z1 - z2], 0.6 Im[z1 - z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
            Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
            Axes → True, AxesStyle → Arrowheads[{-0.04, 0.04}]];
          Show[
            a,
            b,
            c]
Out[482]= 1 + i
Out[483]= 2 + 2 i

z1+z2 = 3 + 3 i
z1-z2 = -1 - i
z1*z2 = 4 i

z1/z2 =  $\frac{1}{2}$ 

```



10)  $23+8I$  and  $9+45I$

```
In[512]:= z1 = 23 + 8 I
z2 = 9 + 45 I
Print["z1+z2 = ", z1 + z2]
Print["z1-z2 = ", z1 - z2]
Print["z1*z2 = ", z1 * z2]
Print["z1/z2 = ", z1 / z2]
a = Graphics[{Green, Arrow[{0, 0}, {Re[z1 + z2], Im[z1 + z2]}]},
  Text["z1+z2", {2.5 Re[z1 + z2], 0.8 Im[z1 + z2]}], Axes -> True,
  AxesStyle -> Arrowheads[{-0.07, 0.07}], AxesLabel -> {Real, Imaginary}];
b = Graphics[{Cyan, Arrow[{0, 0}, {Re[z1 - z2], Im[z1 - z2]}]},
  Text["z1-z2", {2 Re[z1 - z2], 0.4 Im[z1 - z2]}],
  Axes -> True, AxesStyle -> Arrowheads[{-0.04, 0.04}]];
c = Graphics[{Red, Arrow[{0, 0}, {Re[z1 * z2], Im[z1 * z2]}]},
  Text["z1*z2", {Re[z1 * z2] / 2, 0.8 Im[z1 * z2]}],
  Axes -> True, AxesStyle -> Arrowheads[{-0.04, 0.04}]];
Show[
  a,
  b,
  c]
```

Out[512]=  $23 + 8i$

Out[513]=  $9 + 45i$

$$z1+z2 = 32 + 53i$$

$$z1-z2 = 14 - 37i$$

$$z1*z2 = -153 + 1107i$$

$$z1/z2 = \frac{7}{26} - \frac{107i}{234}$$

