Note: In this problem set, expressions in green cells match corresponding expressions in the text answers.

```
Clear["Global`*"]
```

5 - 11 Principal value Ln z. Find Ln z when z equals

5. - 11

```
Log[-11]
```

```
i π + Log[11]
```

7. 4 - 4 I

```
ComplexExpand[Log[4 - 4 i]]
```

$$-\frac{i\,\pi}{4}+\frac{\text{Log}[32]}{2}$$

```
N[%]
```

```
1.73287 - 0.785398 i
```

9. 0.6 + 0.8 I

```
Log[0.6 + 0.8 i]
```

```
0. + 0.927295 i
```

11. E I

```
Log[e i]
```

$$1+\frac{i\,\pi}{2}$$

12 - 16 All Values of Log x. Find all values and graph some of them in the complex plane.

13. Log[1]

```
ComplexExpand[Log[1]]
```

```
0
```

According to numbered line (3) on p. 637, Log[z]=Log[z] ± 2nπi. The extra factor is ignored by Mathematica however, since the software only concerns itself with the principal

value.

15. Log[e^i]

```
Log[e^i]
```

```
i
```

```
Log[Abs[e^i]] + i Arg[e^i]
```

```
i
```

```
ComplexExpand[Log[Abs[e^i]] + i Arg[e^i]]
```

```
i
```

Mathematica's system of presenting only the principal value of the complex number works against me here. I would have liked to have found a way to get Mathematica to tack on a $2n\pi i$ factor, which would make it match the text answer.

17. Show that the set of values of Log[i^2] differs from the set of values of 2 Log[i].

```
Log[ComplexExpand[i^2]]
```

```
i π
```

```
2 ComplexExpand[ Log[i]]
```

```
i π
```

Mathematica is not responsive.

18 - 21 Equations.Solve for z.

19. Log[z] = 4 - 3 I

```
Solve[Log[z] == 4 - 3 i, z]
```

```
{{z → e^(4-3 i)}}
```

```
dis = e^4 e^(-3 i)
```

```
e^4 e^(-3 i)
```

```
ComplexExpand[dis]
```

```
e^4 Cos[3] - i e^4 Sin[3]
```

21. Log[z] = 0.6 + 0.4 I

```
Clear["Global`*"]
```

```
Solve[Log[z] == 0.6 + 0.4 I, z]
{{z → 1.67828 + 0.709566 ⅈ}}

dib = ℯ^0.6 ℯ^(0.4 ⅈ)
```

```
1.67828 + 0.709566 ⅈ
```

I don't know how to make Mathematica cough up Euler's identity, so the symbolic version of the answer is not here.

22 - 28 General Powers. Find the principal value.

23. $(1+i)^{1-i}$

```
Clear["Global`*"]

ComplexExpand[(1 + ⅈ)^(1-ⅈ)]
```

$$\sqrt{2}\, e^{\pi/4} \text{Cos}\left[\frac{\pi}{4} - \frac{\text{Log}[2]}{2}\right] + i\sqrt{2}\, e^{\pi/4} \text{Sin}\left[\frac{\pi}{4} - \frac{\text{Log}[2]}{2}\right]$$

```
Simplify[%]
```

$$(1+i)\, e^{\pi/4}\left(\text{Cos}\left[\frac{\text{Log}[2]}{2}\right] - i\,\text{Sin}\left[\frac{\text{Log}[2]}{2}\right]\right)$$

The above cell contains Euler's identity but the text answer does not.

```
(1 + ⅈ) ℯ^(π/4) ℯ^(-Log[2]/2 ⅈ)
(1 + ⅈ) 2^(-ⅈ/2) ℯ^(π/4)

N[%]
```

```
2.80788 + 1.31787 ⅈ
```

25. $(-3)^{3-i}$

```
Clear["Global`*"]

ComplexExpand[(-3)^(3-ⅈ)]
-27 ℯ^π Cos[Log[3]] + 27 ⅈ ℯ^π Sin[Log[3]]

Simplify[%]
-27 ℯ^π (Cos[Log[3]] - ⅈ Sin[Log[3]])

N[%]
```

```
-284.179 + 556.431 ⅈ
```

The numeric equivalent scores, but the text symbolic answer is not what Mathematica comes up with.

```
27. (-1)^(2-i)
```

```
Clear["Global`*"]
```

```
ComplexExpand[(-1)^(2-i)]
```

$$e^{\pi}$$

```
N[%]
```

```
23.1407
```