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

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

1 - 4 Formulas for hyperbolic functions. Show that

1. Cosh[z] = Cosh[x] Cos[y] + I Sinh[x] Sin[y]

```
ComplexExpand[Cosh[x + ⅈ y]]
```

```
Cos[y] Cosh[x] + ⅈ Sin[y] Sinh[x]
```

Sinh[z] = Sinh[x] Cos[y] + I Cosh[x] Sin[y]

```
ComplexExpand[Sinh[x + ⅈ y]]
```

```
ⅈ Cosh[x] Sin[y] + Cos[y] Sinh[x]
```

6 - 12 Function Values. Find, in the form u+*i* v,

7. Cos[I], Sin[I]

```
ComplexExpand[Cos[ⅈ]]
```

```
Cosh[1]
```

```
N[%]
```

```
1.54308
```

```
ComplexExpand[Sin[ⅈ]]
```

```
ⅈ Sinh[1]
```

```
N[%]
```

```
0. + 1.1752 ⅈ
```

9. Cosh[-1 + 2 I], Cos[-2 - I]

```
ComplexExpand[Cosh[-1 + 2 ⅈ]]
Cos[2] Cosh[1] - ⅈ Sin[2] Sinh[1]
```

```
N[%]
```

```
-0.642148 - 1.06861 ⅈ
```

```
ComplexExpand[Cos[-2 - i]]
Cos[2] Cosh[1] - i Sin[2] Sinh[1]

N[%]
-0.642148 - 1.06861 i
```

11. $\text{Sin}[\pi\, i]$, $\text{Cos}\left[\frac{\pi}{2} - \pi\, i\right]$

```
ComplexExpand[Sin[ π i]]
i Sinh[π]

N[%]
0. + 11.5487 i

ComplexExpand[Cos[ π/2 - π i]]
i Sinh[π]

N[%]
0. + 11.5487 i
```

16 - 19 Equations. Find all solutions.

17. Cosh[z] = 0

```
Solve[Cosh[z] == 0, z]
{{z → ConditionalExpression[-i π/2 + 2 i π C[1], C[1] ∈ Integers]},
  {z → ConditionalExpression[i π/2 + 2 i π C[1], C[1] ∈ Integers]}}

FullSimplify[-i π/2 + 2 i π n]
1/2 i (-1 + 4 n) π

Solve[2 n + 1 == 4 n - 1, n]
{{n → 1}}
```

```
Simplify[i π/2 + 2 i π n]
```

$$\frac{1}{2}\, i\, (\pi + 4\, n\, \pi)$$

The Mathematica answers agree with neither the text nor with the s.m. In this case the s.m. does not agree with the text either, implying that the text answer is missing a π factor.

```
Simplify[Cosh[1/2 i (π + 4 n π)], Assumptions → n ∈ Integers]
```

```
0
```

Demonstrating that the Mathematica answer is correct.

```
Simplify[Cosh[(2 n + 1) π i/2], Assumptions → n ∈ Integers]
```

```
0
```

Demonstrating the the s.m. answer is correct.

```
Simplify[Cosh[(2 n + 1) i/2], Assumptions → n ∈ Integers]
```

```
Cos[1/2 + n]
```

Demonstrating that the text answer is not correct.

19. Sinh[z] = 0

```
Solve[Sinh[z] == 0, z]
```

```
{{z → ConditionalExpression[2 i π C[1], C[1] ∈ Integers]},
 {z → ConditionalExpression[i π + 2 i π C[1], C[1] ∈ Integers]}}
```

By inspection, the answers of Mathematica agree with the text, differing only in the arbitrary expression of the (real) constant.