Note: A derivation in predicate logic need not use any of the quantifier-specific rules. The first four problems below are examples of this point.

1. Add missing annotations:

1.	Γ	$\vdash Fc \vee Gd$	.....premise
2.	Δ	$\vdash Fc \supset Fk$	.....premise
3.	Θ	$\vdash Gd \supset He$	..... premise
4.	Fc	$\vdash Fc$	..... __
5.	Δ, Fc	$\vdash Fk$	..... __
6.	Δ, Fc	$\vdash Fk \vee He$	..... __
7.	Gd	$\vdash Gd$	..... __
8.	Θ, Gd	$\vdash He$	..... __
9.	Θ, Gd	$\vdash Fk \vee He$	..... __
10.	Γ, Δ, Θ	$\vdash Fk \vee He$	..... __

2. Add missing annotations:

1.	Γ	$\vdash \forall xFx \vee \exists xGx$	.....premise
2.	Δ	$\vdash \forall xFx \supset \neg\forall xFx$	..... premise
3.	Θ	$\vdash \exists xGx \supset \forall xHx$	.....premise
4.	$\forall xFx$	$\vdash \forall xFx$	..... __
5.	$\Delta, \forall xFx$	$\vdash \neg\forall xFx$	..... __
6.	$\Delta, \forall xFx$	$\vdash \neg\forall xFx \vee \forall xHx$	..... __
7.	$\exists xGx$	$\vdash \exists xGx$	..... __
8.	$\Theta, \exists xGx$	$\vdash \forall xHx$	..... __
9.	$\Theta, \exists xGx$	$\vdash \neg\forall xFx \vee \forall xHx$	..... __
10.	Γ, Δ, Θ	$\vdash \neg\forall xFx \vee \forall xHx$	..... __

3. Fill in the missing items.

1.	Γ	$\vdash Fa \vee (Lb \vee Kc)$	..... premise
2.	Fa	$\vdash Fa$	.....A
3.	__	$\vdash$ __	..... A
4.	Kc	$\vdash (Fa \vee Lb) \vee Kc$	..... 3,__
5.	__	$\vdash$ __	..... 2,$\vee$I
6.	__	$\vdash$ __	..... A
7.	Lb	$\vdash$ __	..... 6,__
8.	__	$\vdash$ __	..... 5,$\vee$I
9.	$Lb \vee Kc$	$\vdash Lb \vee Kc$	.....A
10.	__	$\vdash (Fa \vee Lb) \vee Kc$	..... 7,$\vee$I
11.	__	$\vdash$ __	.....__
12.	Γ	$\vdash (Fa \vee Lb) \vee Kc$	..... 1,8,11,$\vee$E

4. Fill in the missing items.

1.	Γ	$\vdash \exists xFx \vee (\forall xLx \vee \exists xKx)$	.....premise
2.	$\exists xFx$	$\vdash \exists xFx$	..... A
3.	__	$\vdash$ __	..... A
4.	$\exists xKx$	$\vdash (\exists xFx \vee \forall xLx) \vee \exists xKx$	..... 3,__
5.	__	$\vdash$ __	..... 2,$\vee$I
6.	__	$\vdash$ __	..... A
7.	$\forall xLx$	$\vdash$ __	..... 6,__
8.	__	$\vdash$ __	..... 5,$\vee$I
9.	$\forall xLx \vee \exists xKx$	$\vdash \forall xLx \vee \exists xKx$	.....A
10.	__	$\vdash (\exists xFx \vee \forall xLx) \vee \exists xKx$	..... 7,$\vee$I
11.	__	$\vdash$ __	.....__
12.	Γ	$\vdash (\exists xFx \vee \forall xLx) \vee \exists xKx$	..... 1,8,11,$\vee$E

5. Fill in missing items.

1.	__	$\vdash \forall x Fx$	..... A
2.	$\forall x Gx$	$\vdash$ __	..... A
3.	__	$\vdash$ __	..... 1,$\forall$E
4.	__	$\vdash$ __	..... 2,$\forall$E
5.	__	$\vdash Fa \wedge Ga$	..... 3,4, $\wedge$I
6.	$\forall x Fx, \forall x Gx$	$\vdash \forall x(Fx \wedge Gx)$	..... __

6. Fill in missing items.

1.	__	$\vdash$ __	..... A
2.	__	$\vdash \forall x Fx$	..... A
3.	__	$\vdash$ __	..... 2,$\forall$E
4.	__	$\vdash$ __ $\vee Gk$	..... 3,$\vee$I
5.	$\forall x Gx$	$\vdash \forall x Gx$	..... __
6.	__	$\vdash$ __	..... 5,$\forall$E
7.	__	$\vdash Fk \vee$ __	..... 6,$\vee$I
8.	$\forall x Fx \vee \forall x Gx$	$\vdash Fk \vee Gk$	..... 1,4,7,$\vee$E
9.	__	$\vdash \forall x(Fx \vee Gx)$	..... 8,$\forall$I

7. Fill in missing items.

1.	$\forall x Fx$	$\vdash \forall x Fx$	..... __
2.	$\forall x Fx$	$\vdash Fa$	..... __
3.	$\forall x Fx$	$\vdash \exists x Fx$	..... __

8. Fill in missing items.

1.	$\neg\forall xFx$	$\vdash \neg\forall xFx$	A
2.	$\neg\exists x\neg Fx$	$\vdash \neg\exists x\neg Fx$	A
3.	__	$\vdash$ __	A
4.	__	$\vdash$ __	3,$\exists$I
5.	__	$\vdash$ __	2
6.	$\neg\exists x\neg Fx$	$\vdash$ __	4,5,$\neg$I
7.	$\neg\exists x\neg Fx$	$\vdash Fa$	6,$\neg$E
8.	$\neg\exists x\neg Fx$	$\vdash \forall xFx$	__
9.	$\neg\forall xFx, \neg\exists x\neg Fx$	$\vdash \neg\forall xFx$	__
10.	$\neg\forall xFx$	$\vdash \neg\neg\exists x\neg Fx$	__
11.	$\neg\forall xFx$	$\vdash \exists x\neg Fx$	10,$\neg$E

9. Fill in missing items.

1.	$\neg\exists xFx$	$\vdash \neg\exists xFx$	A
2.	__	$\vdash$ __	A
3.	__	$\vdash$ __	2,$\exists$I
4.	__	$\vdash$ __	1
5.	$\neg\exists xFx$	$\vdash \neg Fa$	3,4,$\neg$I
6.	$\neg\exists xFx$	$\vdash \exists x\neg Fx$	5,$\exists$I

10. Fill in missing items. Hint: Line 1 is a theorem of sentential logic. Lines 2 and 3 are simply citing the results of Q3 and Q4; leave them untouched.

1.		$\vdash$ __	__
2.	$\forall xFx$	$\vdash \exists xFx$	Q3 above
3.	$\neg\forall xFx$	$\vdash \exists x\neg Fx$	Q4 above
4.	$\forall xFx$	$\vdash$ __	__
5.	$\neg\forall xFx$	$\vdash$ __	__
6.		$\vdash \exists xFx \vee \exists x\neg Fx$	1,4,5,$\vee$E

11. Fill in missing items.

1.	$\forall x(Fx \supset Gx)$	$\vdash$	$\forall x(Fx \supset Gx)$	..... __
2.	__	$\vdash$	__	..... A
3.	__	$\vdash$	__	..... 1, $\forall$E
4.	__	$\vdash$	__	..... __
5.	$\forall x(Fx \supset Gx), Fa$	$\vdash$	Ga	..... 3,4,$\supset$E
6.	__	$\vdash$	$\neg Ga$	..... 2,$\forall$E
7.	__	$\vdash$	$\neg Ga$	..... __
8.	$\forall x(Fx \supset Gx), \forall x\neg Gx$	$\vdash$	$\neg Fa$	..... 5,7,$\neg$I
9.	__	$\vdash$	$\forall x\neg Fx$	..... 8,$\forall$I

12. Fill in missing items.

1.	$\exists xFx \vee \exists xGx$	$\vdash$	$\exists xFx \vee \exists xGx$	..... A
2.	__	$\vdash$	__	..... __
3.	__	$\vdash$	__	..... A
4.	__	$\vdash$	__	..... 3,$\vee$I
5.	Fa	$\vdash$	__	..... 4,$\exists$I
6.	$\exists xFx$	$\vdash$	$\exists x(Fx \vee Gx)$	..... 2,5,$\exists$E
7.	$\exists xGx$	$\vdash$	$\exists xGx$	..... A
8.	__	$\vdash$	__	..... A
9.	__	$\vdash$	__	..... 8,$\vee$I
10.	__	$\vdash$	__	..... 9,$\exists$I
11.	$\exists xGx$	$\vdash$	$\exists x(Fx \vee Gx)$	..... 7,10,$\exists$E
12.	$\exists xFx \vee \exists xGx$	$\vdash$	$\exists x(Fx \vee Gx)$	..... __

13.

1. $\exists x Fx \vee \exists x Gx \vdash \exists x Fx \vee \exists x Gx$ ..... __
2. $\forall x(Fx \supset Gx) \vdash \forall x(Fx \supset Gx)$ ..... __
3. $\exists x Fx \vdash \exists x Fx$ ..... __
4. $Fa \vdash Fa$ ..... __
5. $\forall x(Fx \supset Gx) \vdash Fa \supset Ga$ ..... __
6. $\forall x(Fx \supset Gx), Fa \vdash Ga$ ..... __
7. $\forall x(Fx \supset Gx), Fa \vdash \exists x Gx$ ..... __
8. $\forall x(Fx \supset Gx), \exists x Fx \vdash \exists x Gx$ ..... __
9. $\exists x Gx \vdash \exists x Gx$ ..... __
10. $\exists x Fx \vee \exists x Gx, \forall x(Fx \supset Gx) \vdash \exists x Gx$ ..... __