Rosen 1.3, Exercise 12(b):

Proof. $[(p \to q) \wedge (q \to r)] \to (p \to r)$
Logical equivalences with conditionals:
$\equiv [(\neg p \vee q) \wedge (\neg q \vee r)] \to (\neg p \vee r)$
$\equiv \neg[(\neg p \vee q) \wedge (\neg q \vee r)] \vee (\neg p \vee r)$
De Morgan's law use twice:
$\equiv [\neg(\neg p \vee q) \vee \neg(\neg q \vee r)] \vee (\neg p \vee r)$
Double negation law used twice:
$\equiv [(p \wedge \neg q) \vee (q \wedge \neg r)] \vee (\neg p \vee r)$
Distributive law:
$\equiv [(p \vee (q \wedge \neg r)) \wedge (\neg q \vee (q \wedge \neg r))] \vee (\neg p \vee r)$
$\equiv [((p \vee q) \wedge (p \vee \neg r)) \wedge ((\neg q \vee q) \wedge (\neg q \vee \neg r))] \vee (\neg p \vee r)$
Negation law:
$\equiv [((p \vee q) \wedge (p \vee \neg r)) \wedge (T \wedge (\neg q \vee \neg r))] \vee (\neg p \vee r)$
Identity law:
$\equiv [((p \vee q) \wedge (p \vee \neg r)) \wedge (\neg q \vee \neg r)] \vee (\neg p \vee r)$
Associative law:
$\equiv [(p \vee q) \wedge (\neg q \vee \neg r) \wedge (p \vee \neg r)] \vee (\neg p \vee r)$
Distributive law:
$\equiv [((p \vee q) \wedge (\neg q \vee \neg r)) \vee (\neg p \vee r)] \wedge [(p \vee \neg r) \vee (\neg p \vee r)]$
Associative law:
$\equiv [((p \vee q) \wedge (\neg q \vee \neg r)) \vee (\neg p \vee r)] \wedge [(p \vee \neg p) \vee (r \vee \neg r)]$
Negation law:
$\equiv [((p \vee q) \wedge (\neg q \vee \neg r)) \vee (\neg p \vee r)] \wedge [T \vee (r \vee \neg r)]$
Domination law:
$\equiv [((p \vee q) \wedge (\neg q \vee \neg r)) \vee (\neg p \vee r)] \wedge T$
Identity law:
$\equiv ((p \vee q) \vee (\neg p \vee r)) \wedge ((\neg q \vee \neg r) \vee (\neg p \vee r))$
Distributive law:
$\equiv ((p \vee \neg p) \vee (q \vee r)) \wedge ((r \vee \neg r) \vee (\neg p \vee \neg q))$
Associative law:
$\equiv (T \vee (q \vee r)) \wedge (T \vee (\neg p \vee \neg q))$
Negation law:
$\equiv (T \vee (q \vee r)) \wedge (T \vee (\neg p \vee \neg q))$
Domination law:
$\equiv T \wedge T$
Identity law:
$\equiv T$

q.e.d.

$\square$

Rosen 1.3, Exercise 28:

Proof.

p	q	$p \leftrightarrow q$	$\neg p \leftrightarrow \neg q$
T	T	T	T
T	F	F	F
F	T	F	F
F	F	T	T

q.e.d.

□

Rosen 1.3, Exercise 62(c):

This compound proposition is satisfiable when p, q and s are true and r is false

Put the steps and arguments you used to arrive at your answer here.

$(p \vee q \vee r) \wedge (p \vee \neg q \vee \neg s) \wedge (q \vee \neg r \vee s) \wedge (\neg p \vee r \vee s) \wedge (\neg p \vee q \vee \neg s) \wedge (p \vee \neg q \vee \neg r) \wedge (\neg p \vee \neg q \vee s) \wedge (\neg p \vee \neg r \vee \neg s)$

In order to be satisfiable, there must be the possibility of a true output, That would require all the following statements to be true:
$(p \vee q \vee r)$
$(p \vee \neg q \vee \neg s)$
$(q \vee \neg r \vee s)$
$(\neg p \vee r \vee s)$
$(\neg p \vee q \vee \neg s)$
$(p \vee \neg q \vee \neg r)$
$(\neg p \vee \neg q \vee s)$
$(\neg p \vee \neg r \vee \neg s)$

In the case that p, q and s are true and r is false, the statement will come out to be true in the end which will prove that it is satisfiable.

Add-on : Put the compound proposition from Rosen1.3, Exercise 12(b) in disjunctive normal form.

$$(p \wedge q \wedge r) \vee (p \wedge q \wedge \neg r) \vee (p \wedge \neg q \wedge r) \vee (p \wedge \neg q \wedge \neg r) \vee (\neg p \wedge q \wedge r) \vee (\neg p \wedge q \wedge \neg r) \vee (\neg p \wedge \neg q \wedge r) \vee (\neg p \wedge \neg q \wedge \neg r)$$

Your work goes here

$[(p \to q) \wedge (q \to r)] \to (p \to r)$

p	q	r	$[(p \to q) \wedge (q \to r)] \to (p \to r)$
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	T
F	T	T	T
F	T	F	T
F	F	T	T
F	F	F	T

The disjunctive normal form has all instances where the statement is true and this is is a tautology so all instances of the statement will be true.
Therefore the disjunctive normal form will be:
$(p \wedge q \wedge r) \vee (p \wedge q \wedge \neg r) \vee (p \wedge \neg q \wedge r) \vee (p \wedge \neg q \wedge \neg r) \vee (\neg p \wedge q \wedge r) \vee (\neg p \wedge q \wedge \neg r) \vee (\neg p \wedge \neg q \wedge r) \vee (\neg p \wedge \neg q \wedge \neg r)$

Rosen 1.4, Exercise 8(c):

There exists at least one animal that, if it is a rabbit, then it hops.

Your work goes here

$\exists x(R(x) \to H(x))$

R(x): x is a rabbit
H(x): x hops
Domain: animals

There exists at least one animal that $R(x) \to H(x)$
There exists at least one animal that, it is a rabbit $\to$ it hops
There exists at least one animal that, if it is a rabbit, then it hops.

Rosen 1.4, Exercise 10(c):

$\exists x(C(x) \land F(x) \land \neg D(x))$

Your work goes here

C(x): x has a cat
D(x): x has a dog
F(x): x has a ferret
Domain: all students in class

Some student in your class has a cat and a ferret, but not a dog.

Some student in your class: $\exists x$
has a cat: C(x)
and a ferret: $\land$ F(x)
but not a dog: $\land$ $\neg$ D(x)

$\exists x(C(x) \land F(x) \land \neg D(x))$

Rosen 1.4, Exercise 18(e):

$$\neg(P(-2) \lor P(-1) \lor P(0) \lor P(1) \lor P(2))$$

Your work goes here

P(x): Propositional function
Integers in function: 2, 1, 0, 1, and 2

$\neg\exists x P(x)$
Listing out all possible P(x) values
$\neg\exists x$ (P(-2), P(-1), P(0), P(1), P(2))
$\exists x$ is converted to or
$\neg(P(-2) \lor P(-1) \lor P(0) \lor P(1) \lor P(2))$

Rosen 1.4, Exercise 28(d):

$\neg\exists x(P(x) \land Q(x))$

Your work goes here

Nothing is in the correct place and is in excellent condition.
P(x): x is is the correct place
Q(x): x is in excellent condition

Nothing is in the correct place and is in excellent condition.
$\neg\exists x$(in the correct place and is in excellent condition)
$\neg\exists x(P(x) \land Q(x))$

Rosen 1.4, Exercise 36(c):

x = 0

Your work goes here

$\forall x(|x| > 0)$
Prove there exists a real number x such that $|x| > 0$ is false.
for $|x| > 0$ to be false, there must be $|x| \leq 0$
for x = 0, $|x| = |0| = 0$ which satisfies $|x| \leq 0$ so the counterexample is x = 0

Rosen 1.5, Exercise 4(c):

Every student in the class has taken at least one computer science course.

Your work goes here

P (x, y): Student x has taken class y
Domain for x: all students in the class
Domain for y: all computer science courses in school

$\forall x \exists y P(x, y)$
P(every student in the class, there is a computer science course)
Every student in the class has taken at least one computer science course.

Rosen 1.5, Exercise 10(e):

$\exists x \forall y F(x, y)$

Your work goes here

F(x, y): x can fool y
Domain of x: all people in the world
Domain of y: all people in the world

Everyone can be fooled by somebody.
Somebody can fool everyone.
F(somebody, everyone)
$\exists x \forall y F(x, y)$

Rosen 1.5, Exercise 14(e):

$$\exists x \forall y \exists z (P(x, y) \land Q(y, z))$$

Your work goes here

There is a student in this class who has taken every course offered by one of the departments in this school.

P(x, y): student x has taken course y
Q(y, z): course y offered by department z
Domain of x: all the students in the class
Domain of y: courses offered
Domain of z: departments in the school

$\exists x \forall y \exists z (P(x, y) \land Q(y, z))$

Rosen 1.5, Exercise 24(d):

For all pairs of numbers, both numbers are equal to 0 if and only if the product of both numbers is equal to 0.

Your work goes here

$\forall x \forall y((x \neq 0) \wedge (y \neq 0) \leftrightarrow (xy \neq 0))$
$\forall x \forall y($x and y are not equal to 0 if and only if the product of both numbers is equal to 0)
For all pairs of numbers, both numbers are equal to 0 if and only if the product of both numbers is equal to 0.

Rosen 1.5, Exercise 38(d):

All of the students in this class have not been in any of the rooms of one building on campus.

Your work goes here

There is a student in this class who has been in atleast one room of every building on campus.
S(x, y, z): student x has been in room y of building z on campus
Domain of x: all students in the class
Domain of y: all rooms
Domain of z: all building on campus

$\exists x \exists y \forall z S(x, y, z)$

for the negation:
$\neg \exists x \exists y \forall z S(x, y, z)$
using De Morgan's Law:
$\forall x \forall y \exists z \neg S(x, y, z)$

Back in English:
All of the students in this class have not been in any of the rooms of one building on campus.