

1.1.3 (e)

P is false.

q is true

r is false

s is true

q	s	$q \oplus s$
T	T	F

$$\boxed{q \oplus s = \text{False}}$$

1.1.4 (a)

February has 31 days or the number 5 is an integer.

"or" = \vee : True

"or" = \oplus : True

$p = \text{false}$

$q = \text{true}$

$p \vee q = \text{true}$

$p \oplus q = \text{true}$

1.1.4 (e)

January has exactly 31 days or April has exactly 30 days

$p = \text{true}$

$q = \text{true}$

"or" = \vee : True

"or" = \oplus : False

$p \vee q = \text{true}$ $p \oplus q = \text{false}$

1.2.2 (a)

It is windy and cold.

$$\boxed{P \wedge q}$$

P: It is windy
q: It is cold
r: It is raining

1.2.2 (c)

It is not true that it is windy or cold.

$$\boxed{\neg(p \vee q)}$$

1.2.3 (e)

$$P = T, q = T, s = F$$

$$\begin{aligned} &= \neg(q \wedge p \wedge \neg s) \\ &= \neg(T \wedge T \wedge \neg F) \\ &= \neg(T \wedge T \wedge T) \\ &= \neg(T) = F \end{aligned}$$

$$\boxed{F}$$

1.2.4 (c)

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

P	q	r	<u>$p \wedge \neg q$</u>	<u>$r \vee (p \wedge \neg q)$</u>
T	T	T	F	T
T	T	F	F	F
T	F	T	F	T
T	F	F	F	T
F	T	T	F	T
F	T	F	F	F
F	F	T	F	T
F	F	F	F	F

1.2.7 (b)

B: presents birth cert.

D: presents driver's license

M: presents marriage license

$$(B \wedge D) \vee (B \wedge M) \vee (D \wedge M)$$

1.3.2 (b)IF he trained for the race, then he finished the race
 $\Leftarrow p \qquad q \rightarrow \neg p$ Inverse: $\neg p \rightarrow \neg q$ Contrapositive: $\neg q \rightarrow \neg p$ Converse: $q \rightarrow p$

$$p \rightarrow q$$

1.3.4 (c)

$$(p \vee q) \leftrightarrow (q \rightarrow \neg p)$$

p	q	$p \vee q$	$q \rightarrow \neg p$	$(p \vee q) \leftrightarrow (q \rightarrow \neg p)$
T	T	T	F	F
T	F	T	T	T
F	T	T	T	T
F	F	F	T	F

1.3.5 (a)

c: I will return to college.

j: I will get a job.

$$\boxed{\neg j \rightarrow c}$$

1.3.5 (c)

$$\boxed{\neg j \rightarrow \neg c}$$

1.3.7 (b)

s: a person is a senior

y: " " " at least 17 y/o

p: " " " allowed to park in the school parking lot

$$\boxed{p \rightarrow (s \vee y)}$$

1.3.7 (d)

$$\boxed{p \leftrightarrow (s \wedge y)}$$

1.3.8 (d)

w: the roads are wet

a: there was an accident

h: traffic was heavy

$$h \rightarrow (a \vee w)$$

IF traffic was heavy, then there was an accident or the roads are wet.

1.3.10 (b)

p	q	?
T	T	F
T	F	T
F	T	T
F	F	F

$$P \oplus q$$

$$\text{or } \neg(p \leftrightarrow q)$$

1.4.2 (b)

$$\neg(p \leftrightarrow q)$$

and

$$\neg p \leftrightarrow q$$

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

$\neg(p \leftrightarrow q) \equiv \neg p \leftrightarrow q$

1.4.5 (a)

j: Sally got the job

l: Sally was late for her interview

r: Sally updated her resume

$$\neg j \rightarrow (l \vee \neg r) \stackrel{?}{=} (r \wedge \neg j) \rightarrow l$$

j

answer on page 6

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1.4.5 (a) cont.

$$\neg j \rightarrow (l \vee \neg r) \stackrel{?}{=} (r \wedge \neg j) \rightarrow l$$

j	l	r	$\neg j$	$\neg r$	$(l \vee \neg r)$	$r \wedge \neg j$	$\neg j \rightarrow (l \vee \neg r)$	$(r \wedge \neg j) \rightarrow l$
T	T	T	F	F	T	F	T	T
T	T	F	F	T	T	F	T	T
T	F	T	F	F	F	F	T	T
T	F	F	F	T	T	F	T	T
F	T	T	T	F	T	T	T	T
F	T	F	T	T	T	F	T	T
F	F	T	T	F	F	T	F	F
F	F	F	T	T	T	F	T	F

They are logically equivalent

1.5.2 (c)

$$(p \rightarrow q) \wedge (p \rightarrow r) \equiv p \rightarrow (q \wedge r)$$

Conditional Law \times^3

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

Distributive Law

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

1.5.5 (fix =)

x

1.5.5

$$x \wedge \neg y \rightarrow \neg p \stackrel{?}{=} x \wedge p \rightarrow y$$

$p = x - y$

$x, y = \text{rational}$
 $\neg x, \neg y = \text{irrational}$
 Let $p = x - y$

Conditional Law x 2

$$\neg(x \wedge \neg y) \vee \neg p \stackrel{?}{=} \neg(x \wedge p) \vee y$$

De Morgan's Law x 2

$$\neg x \vee y \vee \neg p \stackrel{?}{=} \neg x \vee \neg p \vee y$$

Commutative Law

$$\boxed{\neg x \vee y \vee \neg p \stackrel{?}{=} \neg x \vee y \vee \neg p}$$

✓ logically
equivalent