(1) *Are the following statements true or false (circle one):*

a) e is a real number and $7 < 10$. [true — false]
b) 119 is a prime number and $\sqrt{3}$ is a rational number. [true — false]
c) 119 is not a prime number or $\sqrt{3}$ is a rational number. [true — false]
d) $f(x) = e^x$ and $g(x) = |x|$ are differentiable at $x = 0$. [true — false]
e) $f(x) = e^x$ or $g(x) = |x|$ are differentiable at $x = 0$. [true — false]

(2) *Are the following statements true or false (circle one):*

a) If a and b are integers then $a + b$ is an integer. [true — false]
b) If $\sum_{i=1}^{\infty}(-1)^i|a_i|$ converges, then $\sum_{i=1}^{\infty}|a_i|$ converges. [true — false]
c) If f is continuous at $x = 0$, then f is differentiable there. [true — false]
d) If $\lim_{i\to\infty} a_i = 0$, then $\sum_{i=1}^{\infty} a_i$ converges. [true — false]
e) If $x > 5$ and $y > 5$, then $xy > 15$. [true — false]
f) If $x > 5$ or $y > 5$, then $xy > 15$. [true — false]
g) If squares have (only) three sides, then triangles have four sides. [true — false]

(3) *Rephrase the following statements as 'if - then' statements:*

a) The differentiability of f is sufficient for f to be continuous.

b) k is an even integer whenever $k + 1$ is odd.

c) For all nonzero real numbers b the square b^2 is positive.

d) $nm \geq 1$ provided that n and m are nonzero positive integers.

e) For every positive real number ϵ there is a positive integer n so that $\frac{1}{n} < \epsilon$.

(4) a) *Use truthtables to show that the following conditions are equivalent:*

(A and B) and C – is equivalent to – A and (B and C)
A and (B or C) – is equivalent to – (A and B) or (A and C)

b) *Show that the following sets are equal:*

$(S \cap T) \cap U = S \cap (T \cap U)$
$S \cap (T \cup U) = (S \cap T) \cup (S \cap U)$

(1) *Use truth tables to show:*

(a) $P \Rightarrow Q$ - is equivalent to - (not$Q \Rightarrow$ not$P$) (contrapositive).

(b) not$(P \Rightarrow Q)$ - is equivalent to - P and not$Q$.

(c) $P \Rightarrow Q$ - is NOT equivalent to - $Q \Rightarrow P$

(2) *Negate the following statements:*

(a) e is a real number and $7 < 10$.

(b) 119 is a prime number and $\sqrt{3}$ is a rational number.

(c) 119 is not a prime number or $\sqrt{3}$ is a rational number.

(d) $f(x) = e^x$ and $g(x) = |x|$ are differentiable at $x = 0$.

(e) $f(x) = e^x$ or $g(x) = |x|$ are differentiable at $x = 0$.

(3) *State the contrapositive:*

(a) If a and b are integers then $a + b$ is an integer.

(b) If $\sum_{i=1}^{\infty}(-1)^i|a_i|$ converges, then $\sum_{i=1}^{\infty}|a_i|$ converges.

(c) If f is continuous at $x = 0$, then f is differentiable there.

(d) If $\lim_{i\to\infty} a_i = 0$, then $\sum_{i=1}^{\infty} a_i$ converges.

(e) If $x > 5$ and $y > 5$, then $xy > 15$.

(f) If $x > 5$ or $y > 5$, then $xy > 15$.

(g) If squares have (only) three sides, then triangles have four sides.