SOUTHERN PROVINCE
MUHANGA DISTRICT

SUBSIDIARY MATHEMATICS FOR S6 LFK, HGL, MHLP
MARKING SCHEME FOR SECON TERM
EXAMINATION 2025-2026

1) a) $p \wedge \sim p$ not tautology

p	$\sim p$	$p \wedge \sim p$
T	F	F
F	T	F

b) $p \vee \sim p$: which is tautology

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

c) $p \Leftrightarrow \sim p$: not tautology

p	$\sim p$	$p \Leftrightarrow \sim p$
T	F	F
F	T	F

d) $\sim (p \vee \sim p)$: not tautology

p	$\sim p$	$p \vee \sim p$	$\sim(p \vee \sim p)$
T	F	T	F
F	T	T	F

Thus correct answer is b) $p \vee \sim p$.

(2) Correct answer is b) $p \Rightarrow q$

(3) Correct answer is c) $\sim q \Rightarrow \sim p$

(4) $\sim(p \vee q)$:

p	q	$p \vee q$	$\sim(p \vee q)$
T	T	T	F
T	F	T	F
F	T	T	F
F	F	F	T

b) $\sim p \wedge \sim q$:

p	q	$\sim p$	$\sim q$	$\sim p \wedge \sim q$
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

b) $q \wedge p$:

p	q	$q \wedge p$
T	T	T
T	F	F
F	T	F
F	F	F

c) $\sim p \vee \sim q$:

p	q	$\sim p$	$\sim q$	$\sim p \vee \sim q$
T	T	F	F	F
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

d) $p \wedge q$:

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Correct answer is a) $\sim p \wedge \sim q$.

(T) a) $\sim p \vee q$:

p	q	$\sim p$	$\sim p \vee q$
T	T	F	T
T	F	F	F
F	T	T	T
F	F	T	T

b) $p \wedge q$:

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

c) $\sim(p \vee \sim p)$:

p	$\sim p$	$p \vee \sim p$	$\sim(p \vee \sim p)$
T	F	T	F
F	T	T	F

d) $p \Rightarrow q$:

p	q	$p \Rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

correct answer is c) $\sim(p \vee \sim p)$.

⑥ a) $f(x) = 2x^2 + 2x - 3$

Even: $f(x) = f(-x)$

$f(-x) = 2(-x)^2 + 2(-x) - 3$

$f(-x) = 2x^2 - 2x - 3$

As $f(x) \neq f(-x)$ thus, $f(x)$ is not even.

odd: $f(-x) = -f(x)$

$-f(x) = -(2x^2 + 2x - 3) = -2x^2 - 2x + 3$ not odd.

Therefore $f(x)$ is neither even nor odd.

b) $f(x) = \dfrac{3x^3 + 2x^2 + 8}{x - 4}$

Even: $f(x) = f(-x)$

$f(-x) = \dfrac{3(-x)^3 + 2(-x)^2 + 8}{(-x) - 4}$

$f(-x) = \dfrac{-3x^3 + 2x^2 + 8}{-x - 4}$ not even.

odd: $f(-x) = -f(x)$

$-f(x) = -\left(\dfrac{3x^3 + 2x^2 + 8}{x - 4}\right)$

$-f(x) = \dfrac{-3x^3 - 2x^2 - 8}{x - 4}$ not odd

Thus $f(x)$ is neither even nor odd.

c) $f(x) = \frac{x^2+4}{x^2-4}$

Even: $f(x) = f(-x)$

$f(-x) = \frac{(-x)^2+4}{(-x)^2-4}$

$= \frac{x^2+4}{x^2-4}$

Thus, as $f(x) = f(-x)$ the given function is even.

d) $f(x) = \frac{-2x+1}{x-2}$

$\frac{y}{1} = \frac{-2x+1}{x-1}$

$yx - y = -2x+1$

$yx + 2x = 1+y$

$x(y+2) = 1+y$

$x = \frac{1+y}{y+2}$

$\therefore f^{-1}(x) = \frac{1+x}{x+2}$.

7) $f(x) = 2x-1$ and $g(x) = x^2+2$

a) $fog(x) = f[g(x)]$

$= 2(x^2+2) - 1$

$= 2x^2+4-1$

$\therefore fog(x) = 2x^2+3$.

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b) $gof(x) = g[f(x)]$

$= (2x-1)^2 + 2$

$= 4x^2 - 4x + 1 + 2$

$= 4x^2 - 4x + 3$.

$\therefore gof(x) = 4x^2 - 4x + 3$

c) $fog(5) = 2(5)^2 + 3$

$= 2(25) + 3$

$= 53$

d) $gof(5) = 4(5)^2 - 4(5) + 3$

$= 4(25) - 20 + 3$

$= 100 - 20 + 3$

$= 83$

8) a) i) $\sim(p \wedge q) \equiv \sim p \vee \sim q$.

p	q	$p \wedge q$	$\sim(p \wedge q)$	$\sim p$	$\sim q$	$\sim p \vee \sim q$	$\sim(p \wedge q) \equiv \sim p \vee \sim q$
T	T	T	F	F	F	F	T
T	F	F	T	F	T	T	T
F	T	F	T	T	F	T	T
F	F	F	T	T	T	T	T

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

p	q	r	$q \vee r$	$p \wedge (q \vee r)$
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	T	F
F	T	F	T	F
F	F	T	T	F
F	F	F	F	F

b) $p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$

p	q	r	$q \wedge r$	$p \vee (q \wedge r)$	$p \vee q$	$p \vee r$	$(p \vee q) \wedge (p \vee r)$	$p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$
T	T	T	T	T	T	T	T	T
T	T	F	F	T	T	T	T	T
T	F	T	F	T	T	T	T	T
T	F	F	F	T	T	T	T	T
F	T	T	T	T	T	T	T	T
F	T	F	F	F	T	F	F	T
F	F	T	F	F	F	T	F	T
F	F	F	F	F	F	F	F	T

Thus $p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$ are equivalent. because they have the same truth table values and their equivalent is tautology.

c) $[p \wedge (p \Rightarrow q)] \Rightarrow q$.

p	q	$p \Rightarrow q$	$p \wedge (p \Rightarrow q)$	$[p \wedge (p \Rightarrow q)] \Rightarrow q$
T	T	T	T	T
T	F	F	F	T
F	T	T	F	T
F	F	T	F	T

$\therefore [p \wedge (p \Rightarrow q)] \Rightarrow q$ is tautology.

(9) a) $A(3,2)$ and $B(4,1)$

$\vec{AB} = (1,-1)$

vector equation

$l = \begin{pmatrix} x \\ y \end{pmatrix} = A + t\vec{AB}$ where t is parameter.

$l = \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} + t\begin{pmatrix} 1 \\ -1 \end{pmatrix}$

~~parametric equations~~ parametric equations

$\begin{cases} x = 3 + t \\ y = 2 - t \end{cases}$

cartesian

$x - 3 = -y + 2$

$x + y - 5 = 0$

b) $(-3,5)$ is midpoint of $(2,6)$ and (a,b).

$$\left(\frac{2+a}{2}, \frac{6+b}{2}\right) = (-3,5)$$

$$\begin{cases} \frac{2+a}{2} = -3 \\ \frac{6+b}{2} = 5 \end{cases} \Rightarrow \begin{cases} 2+a = -6 \\ 6+b = 10. \end{cases} \quad \boxed{a=-8} \quad \boxed{b=4}$$

(10) $y = 2x^2 - 8x + 6$

$V\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

$-\frac{b}{2a} = \frac{8}{4} = 2$

$f\left(-\frac{b}{2a}\right) = f(2) = -2$. $\quad V(2,-2)$

Axis of symmetry is 2.

when $x=0$, $y=6$; y-intercept is $(0,6)$

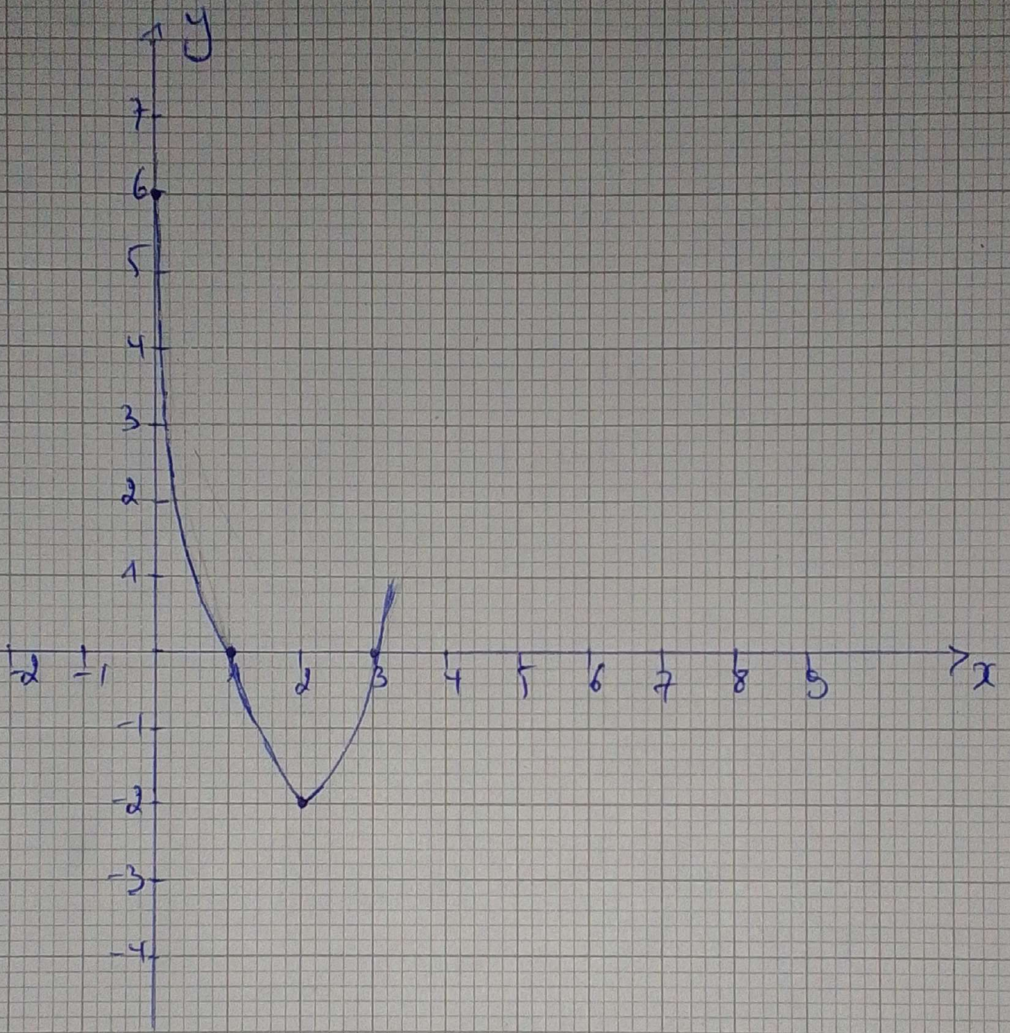
when $y=0$, $x_1=3$ or $x_2=1$

The x-intercepts are $(1,0)$ and $(3,0)$.

⑩ $y = 2x^2 - 8x + 6$

$V(2, -2)$, x-intercepts $(1,0)$ and $(3,0)$

y-intercept $(0,6)$



$C(K, -2)$ and $D(0, 1)$

$d(C, d) = \sqrt{K^2 + (1+2)^2} = \sqrt{K^2+9} = 5$

$(\sqrt{K^2+9})^2 = (5)^2$

$K^2 + 9 = 25$

$K^2 = 16$

$K = \pm 4$.

(12) $\vec{u} = (2, 4)$ and $\vec{v} = (10, 4)$

a) $\vec{u} \cdot \vec{v} = (2,4) \cdot (10,4)$

$= 20 + 16$

$= 36$

b) $\|\vec{u}\| = \sqrt{4+16} = \sqrt{20}$ units

$\|\vec{v}\| = \sqrt{10^2+4^2} = \sqrt{100+16}$

$= \sqrt{116}$.

c) $\vec{u} = (2, -3)$ and $\vec{v} = (6, 4)$.

$\vec{u}$ and $\vec{v}$ are perpendicular if $\vec{u} \cdot \vec{v} = 0$.

$\vec{u} \cdot \vec{v} = (2, -3) \cdot (6, 4) = (12 - 12)$

$= 0$.

$\therefore$ $\vec{u}$ and $\vec{v}$ are perpendicular.

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