Unconventional Well Decline: Duong and Logistic Growth Models

Rate and cumulative production of a shale or tight well by Duong's model and by the logistic growth model, with the instantaneous decline rate and b-factor.

Input parameters

Unit system: SI

Parameter	Value	Unit
Duong: rate at day 1	50.000	bbl/d
Duong intercept a (q/N_p = a t^{−m})	3.9747	
Duong slope m	1.4550	
LGM: ultimate recovery (carrying capacity)	800,000	bbl
LGM constant a (days^n)	221.25	
LGM exponent n	1.0980	
Time on production	1,826.0	d

Calculated results

Parameter	Value	Unit
Rate (Duong)	4.1960	bbl/d
Cumulative production (Duong)	58,751	bbl
Rate (logistic growth)	24.942	bbl/d
Cumulative production (logistic growth)	756,112	bbl
Instantaneous decline rate (LGM), per day	0.001083	
Instantaneous b-factor (LGM)	0.47371	

Notes for this case

• Both models suit long transient linear flow in fractured shale and tight wells, where Arps's b exceeds 1. Fit a and m (Duong) from a log-log plot of q/N_p against t, and K, a and n (LGM) by matching cumulative production. The LGM never exceeds K; Duong is unbounded.

Formula and method

$$q = q_1 t^{-m} \exp\left[\frac{a}{1-m}(t^{1-m}-1)\right], \quad N_p = \frac{q_1}{a}\exp\left[\frac{a}{1-m}(t^{1-m}-1)\right], \quad N_p = \frac{Kt^n}{a+t^n}, \quad q = \frac{Kna\,t^{n-1}}{(a+t^n)^2}$$

Variables

q_1	Duong: rate at day 1	m³/s
a	Duong intercept a (q/N_p = a t^{−m})	-
m	Duong slope m	-
K	LGM: ultimate recovery (carrying capacity)	m³
a_{LGM}	LGM constant a (days^n)	-
n	LGM exponent n	-
t	Time on production	s
q_{Duong}	Rate (Duong)	m³/s
$N_{p,Duong}$	Cumulative production (Duong)	m³
q_{LGM}	Rate (logistic growth)	m³/s
$N_{p,LGM}$	Cumulative production (logistic growth)	m³

D_t	Instantaneous decline rate (LGM), per day	-
b_t	Instantaneous b-factor (LGM)	-

Method and standards

Duong and logistic growth decline models (time in days).

Assumptions and limits

- Constant operating conditions; transient linear flow.

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

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