1. Large Signal Model Quiz

1. For a MOS transistor operating in saturation, if the aspect ratio (W/L) is doubled, then the current (ID) is multiplied by _____.

A	8	B	2	C	4	D	1

2. For an NMOS device, if VGS = 0.7 V and VTH = 0.5 V then the Vov is equal to _____ V.

A	0.4	B	0.3	C	0.2	D	0.1

3. If you have an NMOS and a PMOS, both with the same aspect ratio (W/L) and the same overdrive voltage (Vov), then what is the ratio of the NMOS current to the PMOS current?
   - Assume that μn is 450 cm^2/Vs and μp is 150 cm^2/Vs.

A	2	B	1	C	4	D	3

4. Assume an NMOS device in pinch-off saturation with kn= μn*Cox*W/L = 500 uA/V^2, VTH = 0.4 V, the gate is connected to the ground , the drain to VDD, and the source to a current source sinking 10 μA. The voltage of the source terminal (VS) is equal to _____ V.

A	0.6	B	-0.5	C	-0.6	D	0.5

5. For a MOS transistor operating in pinch-off saturation, if the channel length is multiplied by 4 and ID and W remain unchanged, then the overdrive voltage (Vov) is multiplied by _____.

A	0.5	B	2	C	1	D	0.25

6. PMOS device with body connected to VDD, if the source voltage decreases then |VTH| = ___ .

A	remains unchanged	C	The answer depends on W/L
B	Increases	D	Decreases

7. For a MOSFET operating in velocity saturation, if the overdrive voltage (Vov) is doubled, then the drain current (ID) is multiplied by _____.

A	8	B	1	C	2	D	4

8. For a MOS transistor operating in pinch-off saturation, if the overdrive voltage (Vov) is doubled, then the drain current (ID) is multiplied by _____.

A	4	B	1	C	2	D	8

9. For an NMOS transistor with μn = 400 cm^2/Vs, L = 0.18 μm, VTH = 0.4V and electrons saturation velocity (Vsat) = 10^7 cm/s. If this MOSFET operates with VGS = 1 V, and VDS = 1 V, then it is operated in the _____ region.

A	Velocity Sat.	B	Triode	C	Linear	D	Pinch-off

10. The transistor is best modeled as a ____.

A	VCVS	B	VCCS	C	CCCS	D	CCVS

2. Small Signal Model Quiz

1. From the perspective of transconductance in analog circuits, pinch-off saturation is better than velocity saturation.

A	True	B	False

2. Assume a MOSFET in pinch-off has a constant drain current. If the channel length is doubled and the width remains constant, then the intrinsic gain (gm*ro) will be multiplied by ____.

A	0.5	B	2	C	1	D	1.4

3. One important property that measures the performance of the transistor in analog design is the current efficiency, which is the transconductance per unit current (gm/ID for MOSFET). Usually we need large transconductance, but we want to spend small current because we want to save the energy of our battery. So, the higher the current efficiency, the better. The MOSFET current efficiency is equal to ____.

A	4/Vov	B	2/Vov	C	1/Vov	D	1 / 2 Vov

4. Assume two MOSFETs in pinch-off saturation have the same VGS and the same dimensions. They will have the same ro regardless of VDS.

A	True	B	False

5. For a short channel MOSFET, the behavior of gm vs VGS for VGS > VTH will be ____.

A	Quadratic then linear	C	Linear then saturates
B	Linear only	D	Quadratic only

6. One important property the measures the performance of the transistor in analog design is the intrinsic gain (gm*ro). If Lambda = 1 / VA, then the MOSFET intrinsic gain is equal to _____.

A	(2*VA)/Vov	B	VA/Vov	C	VA/(2*Vov)	D	(4*VA)/Vov

7. One important property that measures the performance of the transistor in analog design is the current efficiency, which is the transconductance per unit current (gm/ID for MOSFET). Usually we need large transconductance, but we want to spend small current because we want to save the energy of our battery. So, the higher the current efficiency, the better. CMOS analog designers typically use an overdrive voltage of around 100-200mV. This means that if ID = 10 uA, then gm will be in the range of _____.

A	200-400 uS	B	10-20 uS	C	100-200 uS	D	50-100 uS

8. For a MOSFET in pinch-off saturation being measured in the lab, if the current is quadrupled then the intrinsic gain (gm*ro) will be multiplied by ____.

A	0.5	B	1	C	1.5	D	2

9. Technology scaling improves the intrinsic gain of the transistor (gm*ro).

A	True	B	False

10. Assume a MOSFET in pinch-off has a constant drain current. If the overdrive voltage is doubled, then gm will be multiplied by ____.

A	0.25	B	0.5	C	2	D	1