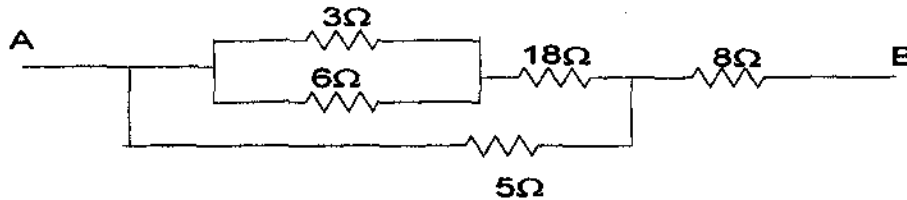


UNIVERSITY OF TECHNOLOGY
DEPARTEMENT OF CHEMICAL – FINAL EXAMINATION 1
 Subject : Basic Electricity Year: First Saad Hassan

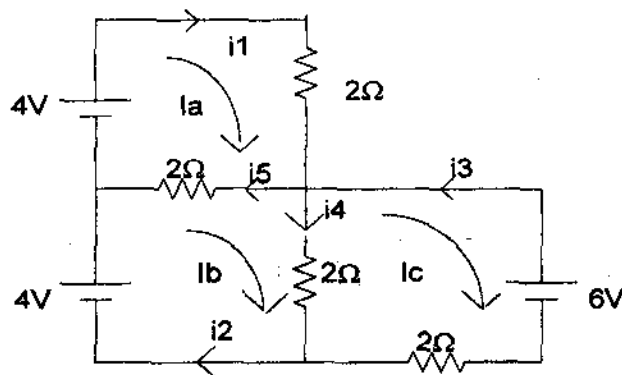
Answer only four questions

Q1- Calculate the effective resistance of the following combination of resistors and the voltage drop across each resistor when 60V applied between points A and B.



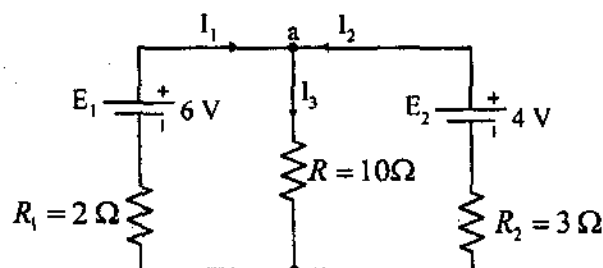
Q2- A conductor has across-section of 15 cm² and specific resistance of $7.6 \mu\Omega \cdot \text{cm}$ at 0°C . If the temperature coefficient of the material is 0.005 per 1°C estimate its resistance in ohm per kilometer when the temperature is 50°C .

Q3- Using Mesh method, Calculate the currents passing through each resistor.



Q4- A coil of 100 turns is rotated at 1500 rev/min in a magnetic field having a uniform density of 0.05 T, the axis of rotation being at right angles to the direction of the flux. The mean area per turn is 40 cm². Calculate, (a) the frequency, (b) the period, (c) the maximum value of the generated e.m.f. and (d) the value of the generated e.m.f. when the coil has rotated through 30° from the position of zero e.m.f.

Q5- using Kirchhoff's law, calculate the current in each branch of the circuit.



Answer four questions including question one.

Q1. Choose the correct expression to Fill each of the following blanks:

1. A chromatogram is a plot of ----- as a function of -----
(a. pH, b. detector response, c. concentration, d. time)
2. ----- is one of the optical methods used for analysis.
(a. potentiometry, b. chromatography, c. spectrometry)
3. The most titrant used as complexing agent is -----
(a. AgNO_3 , b. EDTA, c. $\text{Na}_2\text{S}_2\text{O}_3$)
4. The dissociation of a large molecule into(n) units of monomer by a chemical or thermal process known as -----
(a. copolymerization, b. polymerization, c. depolymerization)
5. ----- is the reaction of alkyl halides with ammonia.
(a. silver mirror test, b. Dow process, c. Hofmann's method)
6. The reaction of natural fats with sodium hydroxide is known -----
(a. hydrogenolysis, b. saponification, c. esterification)
7. Volhard method is one of ----- titrations.
(a. complexation, b. oxidation-reduction, c. precipitation)
8. Nitration of naphthalene is a ----- reaction.
(a. addition, b. substitution, c. elimination)
9. ----- is the milk sugar which is found in the milk of animals.
(a. maltose, b. fructose, c. lactose)

Q2. A. Calculate the molar concentration of (1.0ppm) solution of Li^+ . Atomic weight of $\text{Li}^+ = 6.94\text{g/mol}$.

B. A (0.475gm) sample containing $(\text{NH}_4)_2\text{SO}_4$ was dissolved in water and made alkaline with KOH. The librated NH_3 was distilled into exactly (50ml) of (0.1N)HCl. The excess HCl was back titrated with (11.1ml) of (0.121N) NaOH. Calculate the % NH_3 (M.wt.of $\text{NH}_3 = 17.03$).

Q3. A. Calculate the pH for the titration of (20ml) of (0.11M) ammonia by the addition of (0), (22) and (35)ml of 0.1M HCl. Given that K_b for $\text{NH}_3 = 1.79 \times 10^{-5}$

B. The solubility product constant of magnesium hydroxide is 8.9×10^{-12} , Calculate its solubility in (a) water, and (b) 0.05M NaOH.

Q4. A. write the chemical equations with the catalyst (if present) for preparation of the following compounds.

1. Hexanoic acid from 1- Hexanol
2. Tetraethyllead from ethylchloride.
3. Methylenelether by Williamson's reaction.
4. Bromopropane from 1-propanol.
5. Toluene from benzene by friedel-crafts reaction.

B. Write the chemical structure of the following compounds.

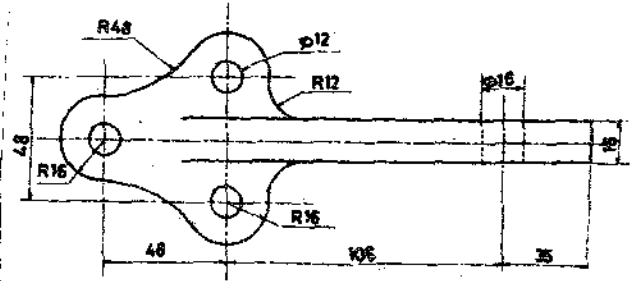
1. Toluene, 2. Fructose, 3. Polystyrene, 4. Butylmercaptan, 5. Ethylamine.

Q5. A. Give the general chemical formula of the following compounds.

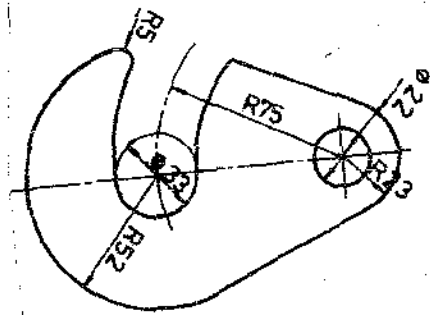
1. Thioester, 2. Tertiary amine, 3. Ketone, 4. Alkyne, 5. Carboxylic acid.

B. What are the classes of heterocyclic compounds? Write the chemical formula and the name of only one compound of each class.

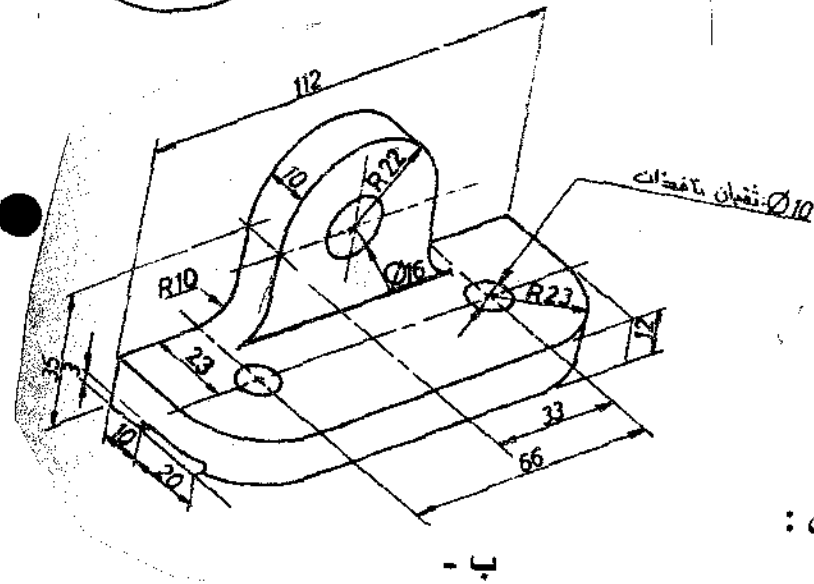
س ١ ارسم لوحد مما يلي بنفس الابعاد
أ-



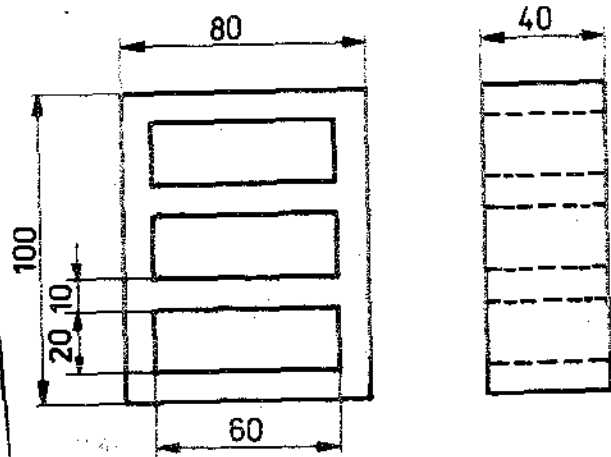
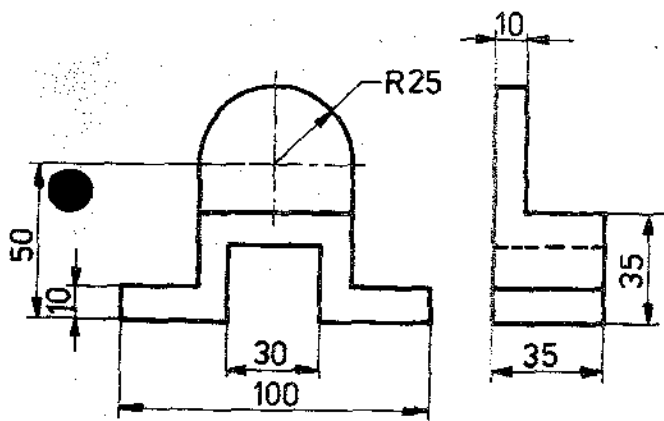
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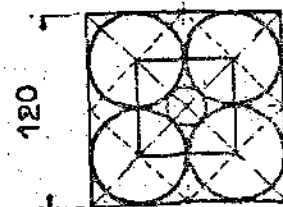
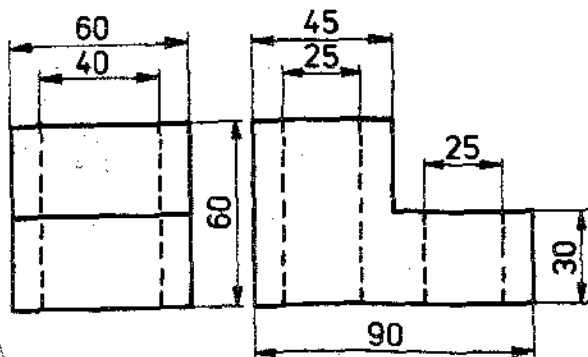
س ٢ ارسم لمايلي
١- المسقط الامامي
٢- المسقط الجانبي
٣- المسقط العلوي



س ٣ ارسم الشكل الايزومتري لوحد ممايلي :
أ-

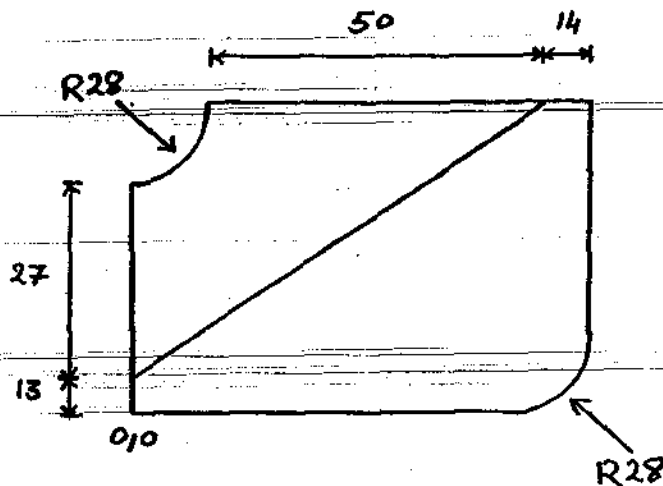


س ٤ Auto cad ارسم لمايلي :



Note: Answer five questions only (Q₁ included).

Q₁: Write down main steps to draw figure below using Auto CAD program.



Q₂: What are the difference between:

1. Divide & Measure commands?
2. Freeze & Hide layers?
3. Main & Secondary memory?
4. Redraw & Regen?
5. Moving & Rotating?
6. Zoom Realtime & Pan Realtime?
7. Single line text & Multiline text?
8. DimStyle & DimScale?
9. Bullet & Numbering?
10. Format Row & Column?

Q₃:

(A) Use polygon to draw a square, and use the rectangular array command to duplicate it in two rows and three columns, with distance between rows and columns equal to 1"?

Hint: polygon having a 0.5" radius.

(B) Give the full name for the expressions :

1. CAD

2. BCC

3. CPU

4. www

Please Turn over

Q₄: (A) Define only five of the followings:

- | | | |
|--------------|----------------|-------------|
| 1. Redo | 2. Zoom window | 3. E - mail |
| 4. Alignment | 5. Leaders | 6. Replace |

(B) In dimensions and texts, what is the meaning of the followings:

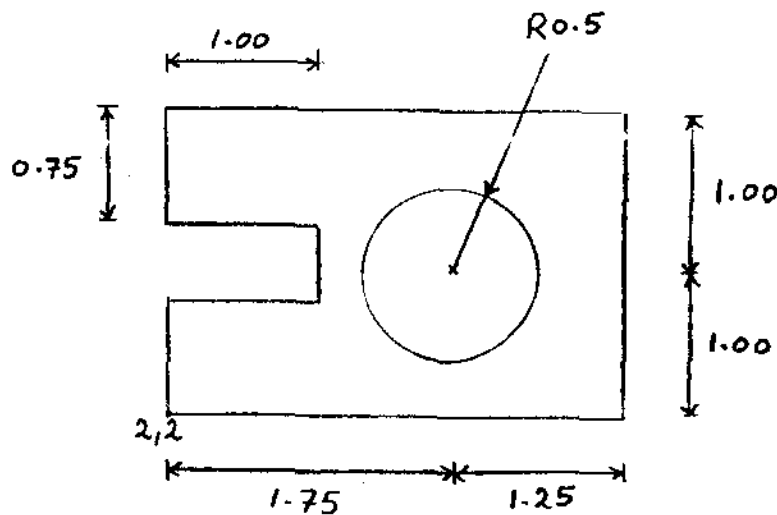
1. Offset from origin.
2. Offset from dim line.
3. Extend beyond dim line.

Q₅: (A) What is the duty of the followings (Answer five only):

- | | | |
|-------------|----------|----------|
| 1. Offset | 2. Trim | 3. Hatch |
| 4. Baseline | 5. Block | 6. Erase |

(B) Briefly describe the following methods of producing circles?

Q₆: (A) Use Auto CAD program commands to draw figure below by using relative coordinates :



(B) Describe a situation in which the mirror command would be helpful?

Good Luck

الموضوع: مبادئ الهندسة الكيميائية
الصف: الأول
الزمن: ثلاث ساعات
المادة: دروس كاملها

الإمتحان النهائي - الدور الأول

٢٠٠٧ - ٢٠٠٨

٢٠٠٨ / ٦ / ٤

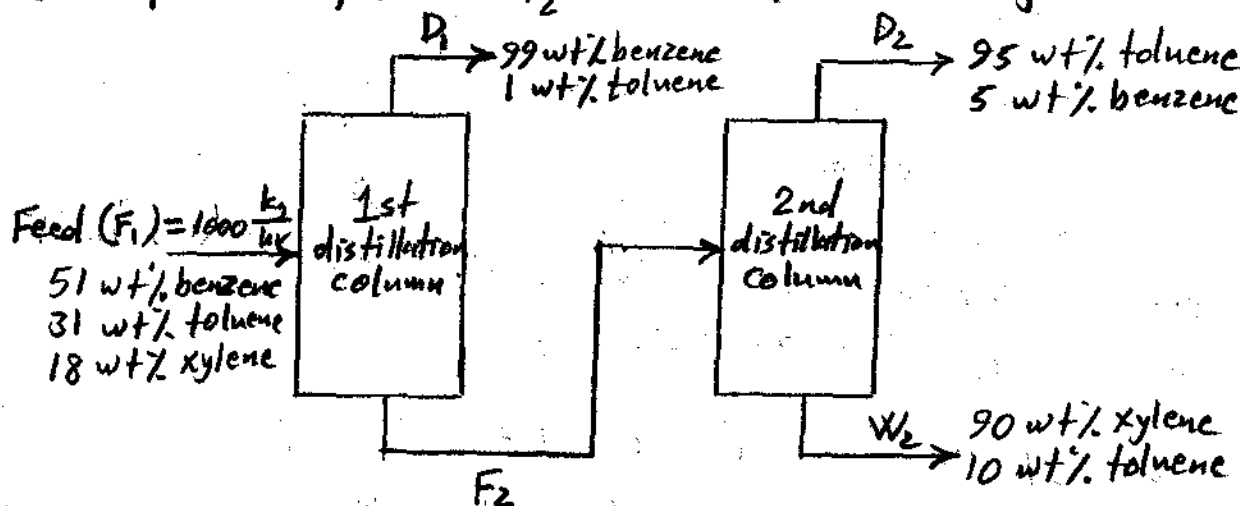
الجامعة التكنولوجية
قسم الهندسة الكيميائية

ملاحظة: اجب عن اربعة اسئلة فقط

Q₁: Fill the following blanks:

- 1- Viscosity (μ) can be expressed in terms of dimensions as _____.
- 2- Pycnometer is the instrument used for _____ measurements.
- 3- _____ is one of the practical scales of specific gravity which is usually used for evaluation of petroleum products. It's relation with spg is: _____.
- 4- The temperature that its value is the same in Fahrenheit and Celsius scales is _____.
- 5- Closed end manometer is used to measure the _____ pressure.
- 6- One liter of 50 ppm NaOH solution contains _____ gm of NaOH.
- 7- _____ stream is used to prevent the accumulation of inert material in the process.
- 8- Van der Waals constants can be estimated from the critical constants according to the relations: $a =$ _____ and $b =$ _____.
- 9- Work and heat are _____ functions, whereas ΔU and ΔH are _____ functions.
- 10- The relationship between C_p and C_v for ideal gas is _____.

Q₂: A ternary mixture (F_1) are continuously fed to the two stage distillation unit at a rate of 1000 kg/hr as shown in the following flow diagram. Calculate the flow rates of streams D_1 , D_2 , F_2 and W_2 in kg/hr and the composition of stream F_2 with complete checking.



Conversion Factors

$$1 \text{ m} = 3.28 \text{ ft}$$

$$1 \text{ ft} = 12 \text{ in} = 30.48 \text{ cm}$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1 \text{ lbf} = 4.448 \text{ N}$$

$$1 \text{ lbm} = 453.6 \text{ gm}$$

$$1 \text{ ft}^3 = 7.48 \text{ gal} = 28.32 \text{ liters}$$

$$1 \text{ Btu} = 252 \text{ cal} = 778 \text{ ft} \cdot \text{lbf}$$

$$1 \text{ cal} = 4.184 \text{ J}$$

$$1 \text{ atm} = 760 \text{ mm Hg}$$

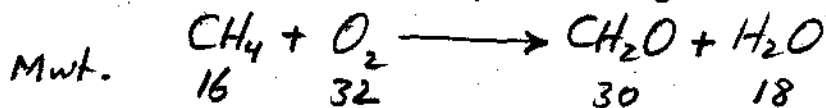
$$= 14.7 \text{ psi}$$

$$= 101.3 \text{ kPa}$$

$$1 \text{ J} = 1 \text{ liter} \cdot \text{kPa}$$

$$1 \text{ kJ} = 10 \text{ liter} \cdot \text{bar}$$

Q₃: Formaldehyde (CH₂O) can be produced by oxidation of methane:



Methane can be oxidized also to carbon dioxide according to the following side reaction: $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O}$

The reaction product out from the reactor contains 35 mol% CH₂O, 2 mol% CO₂, 3 mol% CH₄, 21 mol% O₂ and 39 mol% H₂O.

Calculate: (a) The molal ratio between O₂ and CH₄ input to the reactor.

(b) The limiting reactant, excess reactant and % excess based on the main reaction.

(c) % degree of completion, % conversion and selectivity.

Note: Check the accuracy of calculation by computing total mass input and output.

Q₄: Five lbmoles of ethylene (C₂H₄) are stored in a vessel at 38 °C and absolute pressure of 50.5 atm (non-ideal behaviour) and are then fed to furnace in which it is completely burned with 40% excess air.

Calculate: (a) Volume of the vessel in (ft³) using compressibility factor method.

(b) lbmoles of air required.

(c) The Orsat analysis of the flue gas.

Given that: $T_c = 282.7 \text{ K}$, $P_c = 50.5 \text{ atm}$, $R = 1.3145 \text{ atm} \cdot \text{ft}^3 / \text{lbmole} \cdot \text{K}$.

Q₅ A: Water is being pumped at a rate of 0.5 ft³/sec from a storage tank to a certain exit point of 0.1 ft² cross-sectional area and at a level of 10 ft above the tank. Calculate the horsepower of the pump required for this process. State the assumptions used in the solution. Given that: 1 hp = 550 ft-lbf/sec.

B: Calculate W , Q , ΔU and ΔH for reversible isothermal expansion process on a polyatomic ideal gas from the initial conditions of 27 °C, 25 liters and 200 kPa to the final volume of 50 liters.

Given that: $R = 8.314 \text{ liter} \cdot \text{kPa} / \text{mol} \cdot \text{K} = 8.314 \text{ J} / \text{mol} \cdot \text{K}$

Answer Four Question Only

Q1) Find the following: (choose three only)

1- $\lim_{x \rightarrow 0} \frac{\sqrt{1+2x} - \sqrt[3]{1+3x}}{x^2}$

2- $\lim_{x \rightarrow +\infty} (\cosh^{-1} x - \ln x)$

3- $\lim_{x \rightarrow 0} \frac{\cot 2x}{\csc x}$

4- $\lim_{x \rightarrow \infty} \frac{\ln x}{\sqrt[3]{x}}$

Q2) A- Water runs into a conical tank at a rate of 10 ft³/min. The tank stands point down and has a height of 10ft and a base radius of 5ft. How fast is the water level rising when the water is 6ft deep?

B- Find α , β and γ if

$$2\sin \alpha - \cos \beta + 3\tan \gamma = 3$$

$$4\sin \alpha - 2\tan \gamma + 2\cos \beta = 2$$

$$\tan \gamma - 3\cos \beta + 6\sin \alpha = 9$$

Q3) A- Find the following integrations: (choose two only)

1- $\int \frac{x^3 + 4x^2}{x^2 + 4x + 3} dx$

2- $\int (x^2 - 5x)e^x dx$

3- $\int \frac{dx}{x \ln x}$

B- prove that: $\tanh(\ln x) = \frac{x^2 - 1}{x^2 + 1}$

Q4) A- Find the length of the curve $9x^2 = 4y^3$ from (0, 0) to ($2\sqrt{2}$, 3).

B- If $Z_1 = 3 + \sqrt{-1}$ and $Z_2 = \sqrt{-4} - 1$ find $Z_1 \cdot Z_2$ and Z_1/Z_2 in polar and Euler form.

Q5) A- If $y = \tanh t \cdot \sinh t$ and $x = \cosh t$ prove that :

$$\frac{d^2 y}{dx^2} + \frac{1}{x} \frac{dy}{dx} = \frac{y}{x^2}$$

B- Find the following integrations (choose two only)

1- $\int \frac{2-8x}{1+4x^2} dx$

2- $\int \frac{x^2 + 1}{(x-1)(x-2)(x-3)} dx$

3- $\int_{-1}^0 4^{-x} \ln 2 dx$

Good Luck

$$\sinh^{-1} x = \ln(x + \sqrt{x^2 + 1})$$

$$\cosh^{-1} x = \ln(x + \sqrt{x^2 - 1})$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sec^2 \theta = 1 + \tan^2 \theta$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$\cos^2 \theta = \frac{1 + \cos 2\theta}{2}$$

$$\sin^2 \theta = \frac{1 - \cos 2\theta}{2}$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\frac{d(\sin^{-1} u)}{dx} = \frac{du/dx}{\sqrt{1-u^2}} \quad -1 < u < 1$$

$$\frac{d(\tan^{-1} u)}{dx} = \frac{du/dx}{1+u^2}$$

$$\frac{d(\sec^{-1} u)}{dx} = \frac{du/dx}{|u|\sqrt{u^2-1}} \quad |u| > 1$$

$$\frac{d(\cos^{-1} u)}{dx} = -\frac{du/dx}{\sqrt{1-u^2}}$$

$$\frac{d(\csc^{-1} u)}{dx} = -\frac{du/dx}{|u|\sqrt{u^2-1}} \quad |u| > 1$$

$$\frac{d(\cot^{-1} u)}{dx} = -\frac{du/dx}{1+u^2}$$

$$\int \frac{du}{\sqrt{1+u^2}} = \sinh^{-1} u + C$$

$$\int \frac{du}{\sqrt{u^2-1}} = \cosh^{-1} u + C$$

$$\int \frac{du}{u\sqrt{1-u^2}} = -\sec h^{-1}|u| + C$$

$$\int \frac{du}{u\sqrt{1+u^2}} = -\csc h^{-1}|u| + C$$

$$\int \frac{du}{1-u^2} = \begin{cases} \tanh^{-1} u + C & \text{if } |u| < 1 \\ \coth^{-1} u + C & \text{if } |u| > 1 \end{cases}$$