University Of Technology
Building and Construction Eng. Dept.
Final Exam(1^{st} attempt) – 2013/2014

Subject :Digital Cartography | Class: Second
Branch :Geomatics | Time : 3 Hours
Examiner : L. Safaa Jasim , Dr. Oday Z. Jasim | Date : 9 / 6 / 2014

Answer four (4) equations

ملاحظة تسترجع الأسئلة مع الدفتر الامتحاني

(Q1)

(A) Distribute the values of scale factor on UTM zone (Draw the case). **(10 degree)**

(B) Find the value of the convergence of map scale 1/250000 at the center and at all corners of the map if the geographic coordinates of the SW corner are **(15 degree)**

$\varnothing = 28° 30' 30''N$

$\lambda = 43° 30' 30'' E$

(Q2)

(A) List the steps to construct a simple cylindrical map projection , draw the case, and show the main uses of map produced . **(15 degree)**

(B) Explain by drawing the relation between linear distortion and the position of points on earth? **(10 degree)**

(Q3)

(A) Find the geographic coordinate of point (P) if

$\varnothing_K = 20° 20'N$

$\lambda_K = 22° 22'E$

And the spherical distance (KP) = 600.60 km.
Declination angle between K and P = 50° 30′ **(15 degree)**

(B) Find out the angular distortion formula and discuss the conformality condition of map projection (Draw the case). **(10 degree)**

(Q4)

(A) When (x=532323.5295m), (y=266161.7648m) and (x′=266161.7648m) (y′= 532323.5295 m). Find α between the two coordinate systems, if the origin is fixed in both coordinate system and the rotation of axes is clockwise. **(15 degree)**

(B) List all the differences between the vector and raster data in digital mapping. **(10 degree)**

(Q5)

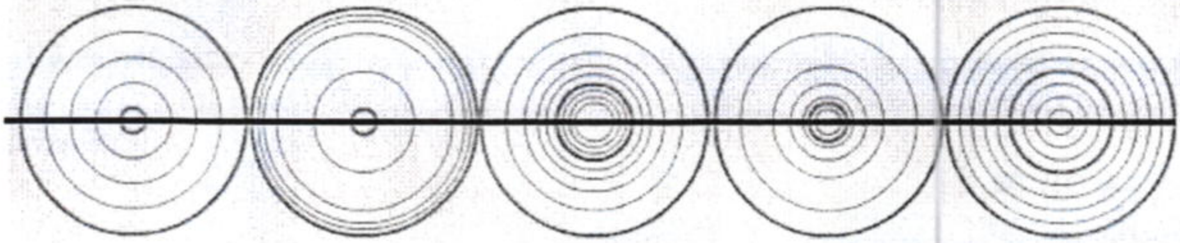
(A) Define a topographic map and show main steps of producing a base topographic map scale (1/25000). **(10 degree)**

(B) Define the generalization and explain one of its main elements. **(5 degree)**

(C) Match by lines between (a) & (b) figures below and discus why. **(10 degree)**

<u>ملاحظة حل فرع C : يتم رسم الخطوط على ورقة الاسئلة فيما يتم الشرح لكل رسم في الدفتر الامتحاني</u>

(a)



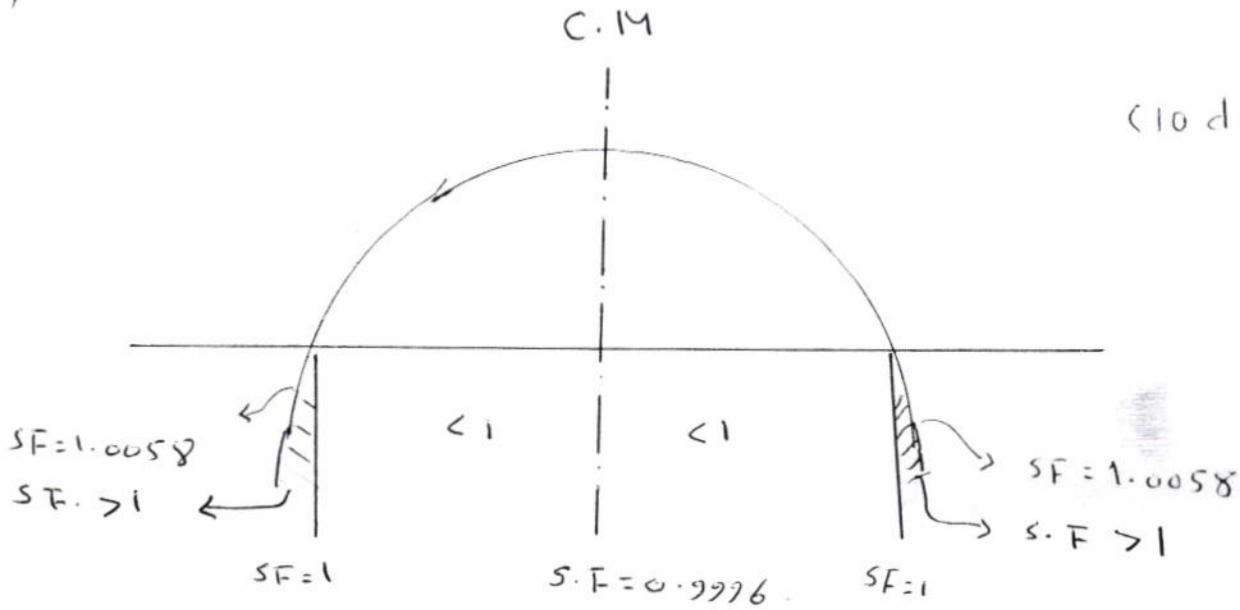
(b)

Good Luck

الحلول النموذجية لاسئلة مادة الخرائط الرقمية فرع الجيوماتيك الدور الاول 014

Q1.A)

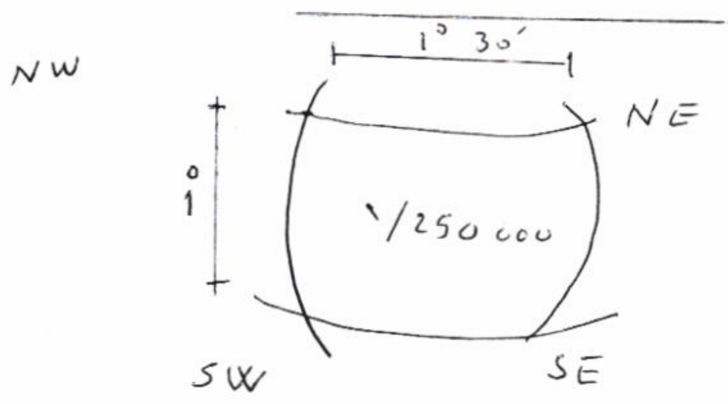
(10 degree)



The circle intersect the cylinder in UTM projection

Q1.B)

(15 degree)



SW Corner: $\phi = 28^\circ\ 30'\ 30''$ N , $\lambda = 43^\circ\ 30'\ 30''$ E

SE Corner: $\phi = 28^\circ\ 30'\ 30''$ N , $\lambda = 45^\circ\ 00'\ 30''$ E

NW Corner: $\phi = 29^\circ\ 30'\ 30''$ N , $\lambda = 43^\circ\ 30'\ 30''$ E

NE Corner: $\phi = 29^\circ\ 30'\ 30''$ N , $\lambda = 45^\circ\ 00'\ 30''$ E

$\phi_{center} = 29^\circ\ 00'\ 30''$ N $\quad \lambda_{center} = 44^\circ\ 15'\ 30''$ E

$\delta = \Delta\lambda \sin\phi \Rightarrow$ The zone of Map is /38/ with C.M $= 45^\circ$

$\delta_{SW} = 00^\circ\ 42'\ 43''.03$, $\delta_{SE} = 00^\circ\ 00'\ 14.32''$, $\delta_{NW} = 00^\circ\ 44'\ 4.99''$

$\mathcal{X}_2$. A)

1. Draw the equator Φ_0 with its true length.

$$L_{\Phi_0} = 2\pi R * scale$$

2. Divid the equator to equal divisions like 10°

$$\lambda_{10} = \frac{2\pi R}{360^\circ} * 10^\circ * scale$$

3. Sign the intersections of meridian with equator

4. Draw straight lines perpendicular to the equator from the points of intersections.

5. Draw the parallels with a straight lines with its true distances from the equator like 10°

$L_{10^\circ} = \frac{2\pi R}{360^\circ} * 10^\circ * scale$, so the length of any great circle = length of equator, and all parrallel has a distortion $= \frac{L \text{ of parallel on proj}}{L \text{ of parallel on earth}}$

$$= \frac{2\pi R}{2\pi R \cos\Phi} = \sec\Phi$$

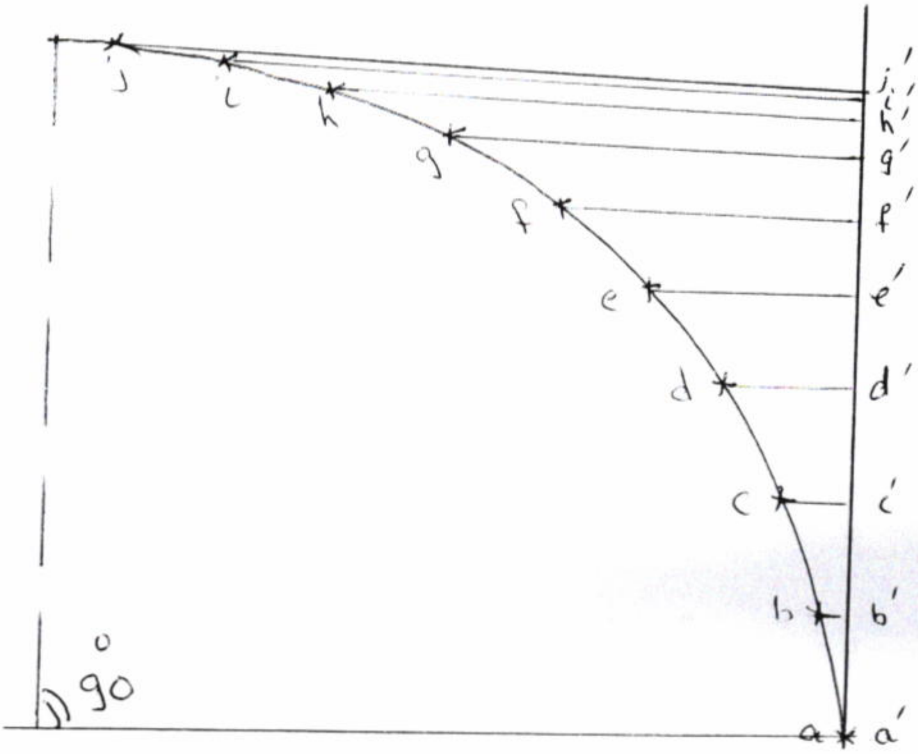
6. the length of meridians between poles is true in this projection

7. All parallels has been exaggerated by $\sec\theta$ except equator

8. poles are infinty exaggerated

(15 degree)

Q₂ . B)



The value of linear distortion is changed from place to another and it is increased as well as the the postion be near the poles and the curvature increased, that means also the relation between linear distortion and changing the direction of points according to the formula

$$M_\alpha = \sqrt{a^2 \sin^2 \alpha + b^2 \cos^2 \alpha}$$

(linear distortion

(10 degree)

Φ_3 . A)

$$\cos(90 - \Phi_p) = \cos(90 - \Phi_k)\cos(S^{\circ}_{kp}) + \sin(90 - \Phi_k)\sin(S^{\circ}_{kp}) \cdot \cos \alpha_{kp}$$

$$\sin \Phi_p = \sin \Phi_k \cos(S^{\circ}_{kp}) + \cos \Phi_k \cdot \sin(S^{\circ}_{kp}) \cdot \cos \alpha_{kp}$$

$$\therefore S^{\circ}_{kp} = \frac{S_{kp}}{R} * \frac{180^{\circ}}{\pi} = 5^{\circ}\ 24'\ 4.47''$$

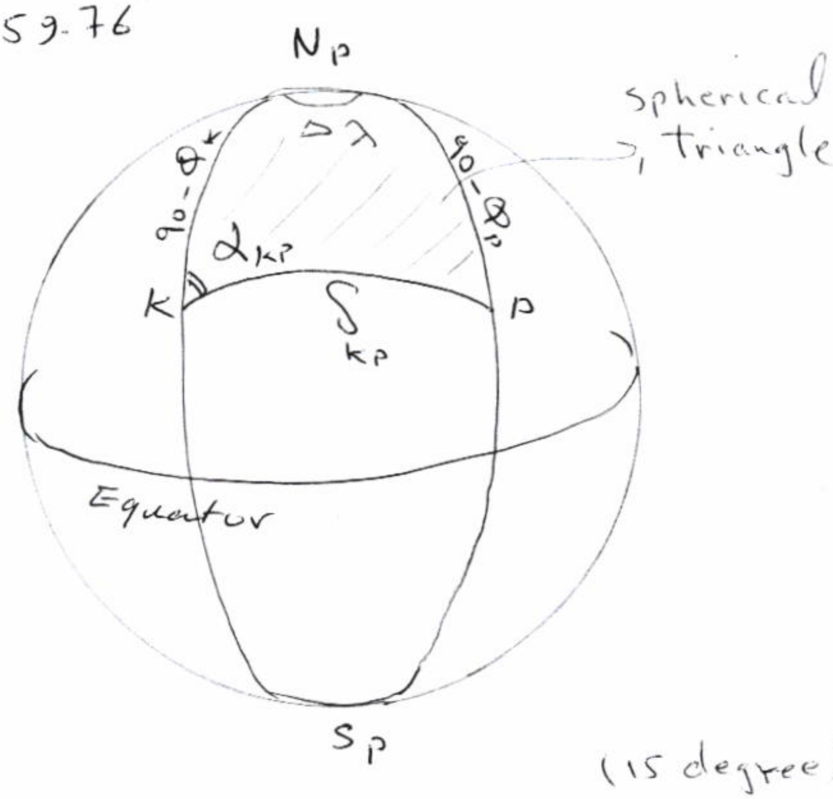
$$\therefore \Phi_p = 23^{\circ}\ 42'\ 36.11''$$

$$\frac{\sin \Delta\lambda}{\sin(S_{kp})^{\circ}} = \frac{\sin \alpha_{kp}}{\sin(90 - \Phi_p)}$$

$$\therefore \Delta\lambda = 4^{\circ}\ 32'\ 59.76''$$

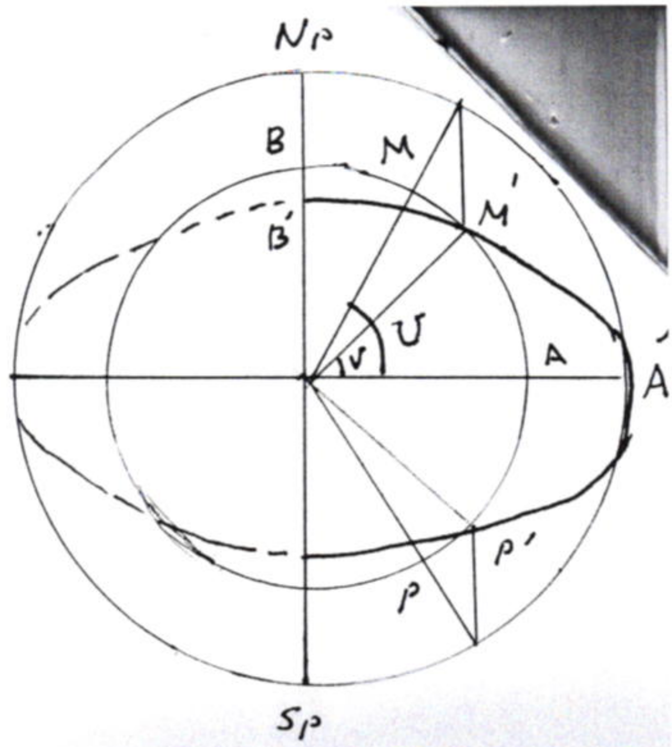
$$\therefore \lambda_p = \lambda_k + \Delta\lambda = 22^{\circ}\ 22' + 4^{\circ}\ 32'\ 59.76''$$

$$\therefore \lambda_p = 26^{\circ}\ 54'\ 59.76''$$

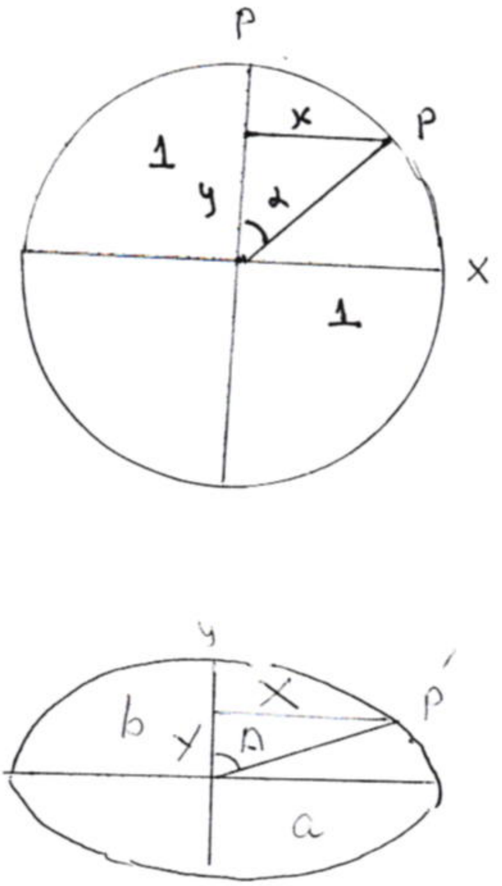


(15 degree)

Q3 · B.)



fig(1)



fig(2)

from fig(2) the angle α on circle has been changed to (A) on ellipse after projection so:

$$\sin A = \frac{X}{\sqrt{X^2+Y^2}} = \frac{ax}{M_\alpha\sqrt{x^2+y^2}}$$

$$\cos A = \frac{Y}{\sqrt{X^2+Y^2}} = \frac{by}{M_\alpha\sqrt{x^2+y^2}}$$

(use the Definition of linear distortion since $\frac{x}{1} = \frac{X}{a}$

$$M_\alpha = \sqrt{a^2\frac{x^2}{x^2+y^2} + b^2\frac{y^2}{x^2+y^2}}$$)

$\therefore \sin A = \frac{a}{M_\alpha}\sin\alpha$, $\cos A = \frac{b}{M_\alpha}\cos\alpha$

(10 degree)

$$M_\alpha = a\,\frac{\sin\alpha}{\sin A} = b\,\frac{\cos\alpha}{\cos A}$$

$\therefore$ $a\sin\alpha\cdot\cos A - b\cos\alpha\sin A = 0$

$$a\left[\sin(A+\alpha) - \sin(A-\alpha)\right] = b\left[\sin(A+\alpha) + \sin(A-\alpha)\right]$$

$\therefore (a-b)\sin(A+\alpha) = (a+b)\sin(A-\alpha)$

$\sin(A-\alpha) = \frac{a-b}{a+b}\sin(A+\alpha)$ [Let $A-\alpha = \omega$]

$\therefore \sin\frac{\omega}{2} = \frac{a-b}{a+b}$

The conformality Condition $\sin\frac{\omega}{2} = \frac{a-b}{a+b} = 0$

$\Longrightarrow a = b$ (circle)