## Practice set 6.1 Page 131

**1. If sinθ = 7/25 , find the values of cosθ and tanθ.**

**Solution:**

Given sinθ = 7/25
We have $\sin^2\theta+\cos^2\theta = 1$
∴ $(7/25)^2+ \cos^2\theta = 1$
$(49/625)+ \cos^2\theta = 1$
$\cos^2\theta = 1-(49/625)$
$\cos^2\theta = (625-49)/625$
$\cos^2\theta = 576/625$
Taking square root on both sides
∴ cosθ = 24/25
tanθ = sinθ/cosθ
= (7/25) ÷(24/25)
= (7/25) ×(25/24)
= 7/24
Hence cosθ = 24/25 and tanθ = 7/24.

**2. If tanθ = 3/4 , find the values of secθ and cosθ.**

**Solution:**

Given tanθ = 3/4
We have $1+\tan^2\theta= \sec^2\theta$
∴ $1+(3/4)^2 = \sec^2\theta$
∴ $1+(9/16) = \sec^2\theta$
$\sec^2\theta = (16+9)/16 = 25/16$
Taking square root on both sides
secθ = 5/4
We have cosθ = 1/secθ
∴ cosθ = 1÷(5/4)
∴ cosθ = 4/5
Hence secθ = 5/4 and cosθ = 4/5.

**3. If cotθ = 40/9 , find the values of cosecθ and sinθ.**

**Solution:**

Given cotθ = 40/9
We have $1+\cot^2\theta = \text{cosec}^2\theta$
∴ $1+(40/9)^2 = \text{cosec}^2\theta$
$1+(1600/81) = \text{cosec}^2\theta$
$(81+1600)/81 = \text{cosec}^2\theta$
$1681/81 = \text{cosec}^2\theta$
$\text{cosec}^2\theta = 1681/81$
Taking square root on both sides
∴ cosecθ = 41/9

We have $\sin\theta = 1/\text{cosec}\theta$
$\therefore \sin\theta = 1\div(41/9)$
$\therefore \sin\theta = 9/41$
Hence $\text{cosec}\theta = 41/9$ and $\sin\theta = 9/41$.

**4. If 5secθ- 12cosecθ = 0, find the values of secθ, cosθ and sinθ.**

**Solution:**
Given $5\sec\theta - 12\text{cosec}\theta = 0$
$\therefore 5\sec\theta = 12\text{cosec}\theta$
$\therefore 5/\cos\theta = 12/\sin\theta$ [$\sec\theta = 1/\cos\theta$ and $\text{cosec}\theta = 1/\sin\theta$]
$\therefore 5/12 = \cos\theta/\sin\theta$
$\therefore \sin\theta/\cos\theta = 12/5$
$\therefore \tan\theta = 12/5$
We know that $1+\tan^2\theta = \sec^2\theta$
$\therefore 1+(12/5)^2 = \sec^2\theta$
$1+(144/25) = \sec^2\theta$
$(25+144)/25 = \sec^2\theta$
$169/25 = \sec^2\theta$
Taking square root on both sides
$\therefore \sec\theta = 13/5$
$\therefore \cos\theta = 1/\sec\theta = 5/13$
We know that $\sin^2\theta+\cos^2\theta=1$
$\therefore \sin^2\theta+(5/13)^2 = 1$
$\therefore \sin^2\theta = 1-(5/13)^2$
$\therefore \sin^2\theta = 1-(25/169)$
$\therefore \sin^2\theta = (169-25)/169$
$\therefore \sin^2\theta = 144/169$
Taking square root on both sides
$\sin\theta = 12/13$
Hence $\sec\theta = 13/5$ , $\cos\theta = 5/13$ and $\sin\theta = 12/13$.

**5. If tanθ = 1 then, find the values of (sinθ+ cosθ)/( secθ+ cosecθ ).**

**Solution:**
Given $\tan\theta = 1$
We know that $\tan 45^\circ = 1$
$\therefore \theta = 45^\circ$
$\therefore \sin 45 = 1/\sqrt{2}$
$\cos 45 = 1/\sqrt{2}$
$\sec 45 = \sqrt{2}$
$\text{cosec} 45 = \sqrt{2}$
$\therefore (\sin\theta+ \cos\theta)/( \sec\theta+ \text{cosec}\theta ) = (\sin 45+ \cos 45)/( \sec 45+ \text{cosec} 45 )$
$= [(1/\sqrt{2})+( 1/\sqrt{2})]\div[\sqrt{2}+\sqrt{2}]$
$= (2/\sqrt{2})\div 2\sqrt{2}$
$= (2/\sqrt{2})\times(1/2\sqrt{2})$
$= 1/2$

Hence $(\sin\theta+\cos\theta)/(\sec\theta+\operatorname{cosec}\theta) = 1/2$

**6. Prove that:**

**(1) $\sin^2\theta/\cos\theta + \cos\theta = \sec\theta$**

**(2) $\cos^2\theta(1 + \tan^2\theta) = 1$**

**(3) $\sqrt{[(1-\sin\theta)/(1+\sin\theta)]} = \sec\theta - \tan\theta$**

**(4) $(\sec\theta - \cos\theta)(\cot\theta + \tan\theta) = \tan\theta\sec\theta$**

**(5) $\cot\theta + \tan\theta = \operatorname{cosec}\theta\sec\theta$**

**(6) $1/(\sec\theta-\tan\theta) = \sec\theta + \tan\theta$**

**Solution:**

(1) $\sin^2\theta/\cos\theta + \cos\theta = (\sin^2\theta+\cos^2\theta)/\cos\theta$

$= 1/\cos\theta$ $[\sin^2\theta+\cos^2\theta = 1]$

$= \sec\theta$ $[1/\cos\theta = \sec\theta]$

Hence proved.

(2) $\cos^2\theta(1 + \tan^2\theta) = \cos^2\theta+\sin^2\theta$ $[\cos^2\theta\times\tan^2\theta = \cos^2\theta\times\sin^2\theta/\cos^2\theta = \sin^2\theta]$

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

Hence proved.

(3) $\sqrt{[(1-\sin\theta)/(1+\sin\theta)]} = \sqrt{[(1-\sin\theta)/(1+\sin\theta)]}\times\sqrt{[(1-\sin\theta)/(1-\sin\theta)]}$ [rationalizing denominator]

$= \sqrt{[(1-\sin\theta)^2/(1-\sin^2\theta)]}$

$= \sqrt{[(1-\sin\theta)^2/\cos^2\theta}$ $[1-\sin^2\theta = \cos^2\theta]$

$= (1-\sin\theta)/\cos\theta$ [taking square root]

$= (1/\cos\theta)-(\sin\theta/\cos\theta)$

$= \sec\theta-\tan\theta$ $[1/\cos\theta = \sec\theta, \sin\theta/\cos\theta = \tan\theta$

Hence proved.

(4) $(\sec\theta - \cos\theta)(\cot\theta + \tan\theta) = \text{LHS}$

$\because \sec\theta = 1/\cos\theta, \cot\theta = \cos\theta/\sin\theta, \tan\theta = \sin\theta/\cos\theta$

LHS $= (1/\cos\theta)-\cos\theta][(\cos\theta/\sin\theta)+(\sin\theta/\cos\theta)]$

LHS $= [(1-\cos^2\theta)/\cos\theta][(\cos^2\theta+\sin^2\theta)/(\text{son}\theta\cos\theta)]$

$= [\sin^2\theta/\cos\theta][1/\sin\theta\cos\theta]$ $[\because 1-\cos^2\theta = \sin^2\theta]$

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

$= \sec\theta\tan\theta$ $[\sin\theta/\cos\theta = \tan\theta, 1/\cos\theta =\sec\theta]$

= RHS

Hence proved.

(5) $\cot\theta + \tan\theta = (\cos\theta/\sin\theta) +(\sin\theta/\cos\theta)$ $[\because \cot\theta = \cos\theta/\sin\theta, \tan\theta = \sin\theta/\cos\theta]$

$= (\cos^2\theta+ \sin^2\theta)/\sin\theta\cos\theta$

$= 1/\sin\theta\cos\theta$ $[\because \cos^2\theta+ \sin^2\theta= 1]$

$= \operatorname{cosec}\theta\sec\theta$ $[1/\sin\theta = \operatorname{cosec}\theta, 1/\cos\theta = \sec\theta]$

Hence proved.

(6) $1/(\sec\theta-\tan\theta) = 1/(\sec\theta-\tan\theta) \times (\sec\theta + \tan\theta)/(\sec\theta+\tan\theta)$ [rationalising denominator]

$= (\sec\theta+\tan\theta)/(\sec^2\theta-\tan^2\theta)$

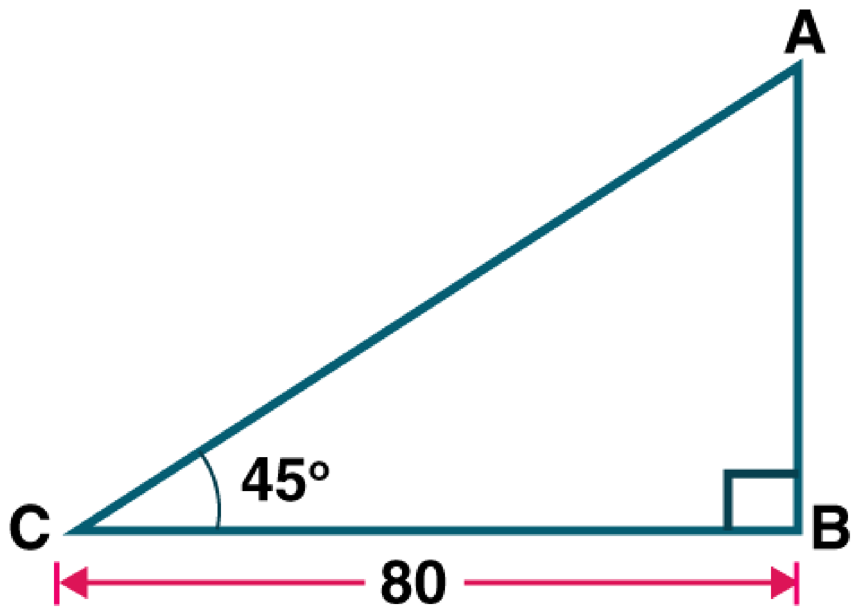
$= \sec\theta+\tan\theta$ $[\because \sec^2\theta-\tan^2\theta = 1]$

Hence proved.

Practice Set 6.2 Page 137

**1. A person is standing at a distance of 80m from a church looking at its top. The angle of elevation is of 45°. Find the height of the church.**

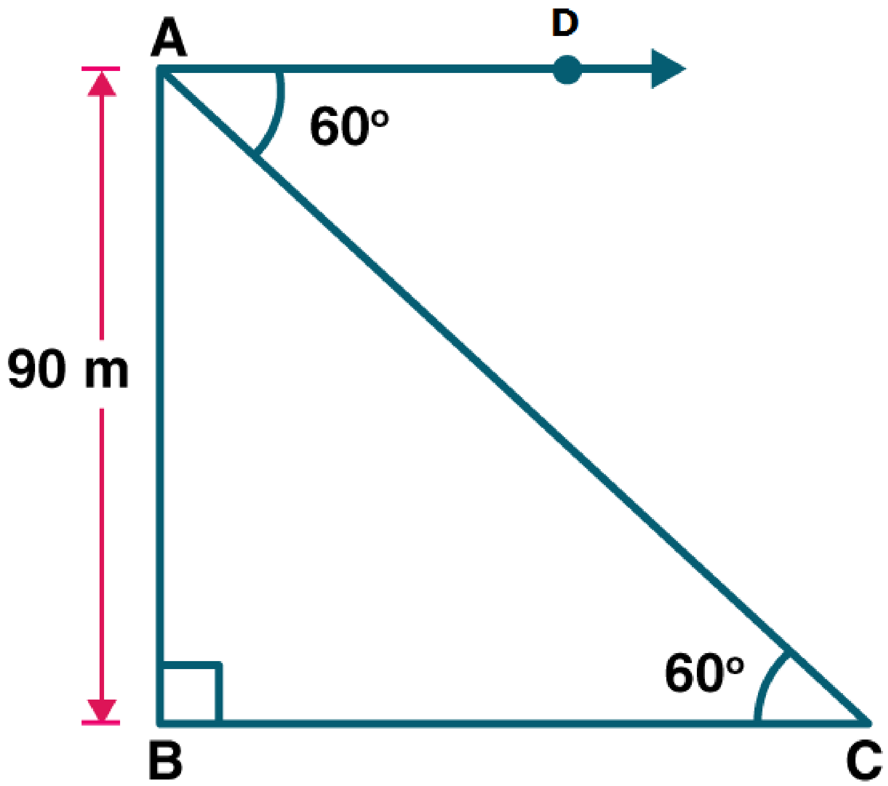
**Solution:**




Let C represent position of person and AB represent height of the church.
Angle of elevation $\theta = \angle C = 45^\circ$
BC = 80m
In right angled triangle ABC , $\tan\theta = \tan 45^\circ = AB/BC$
$\therefore 1 = AB/80$
$\Rightarrow AB = 80$
Hence height of the church is 80m.

**2. From the top of a lighthouse, an observer looking at a ship makes angle of depression of 60°. If the height of the lighthouse is 90 metre, then find how far the ship is from the lighthouse. (√3 =1.73)**

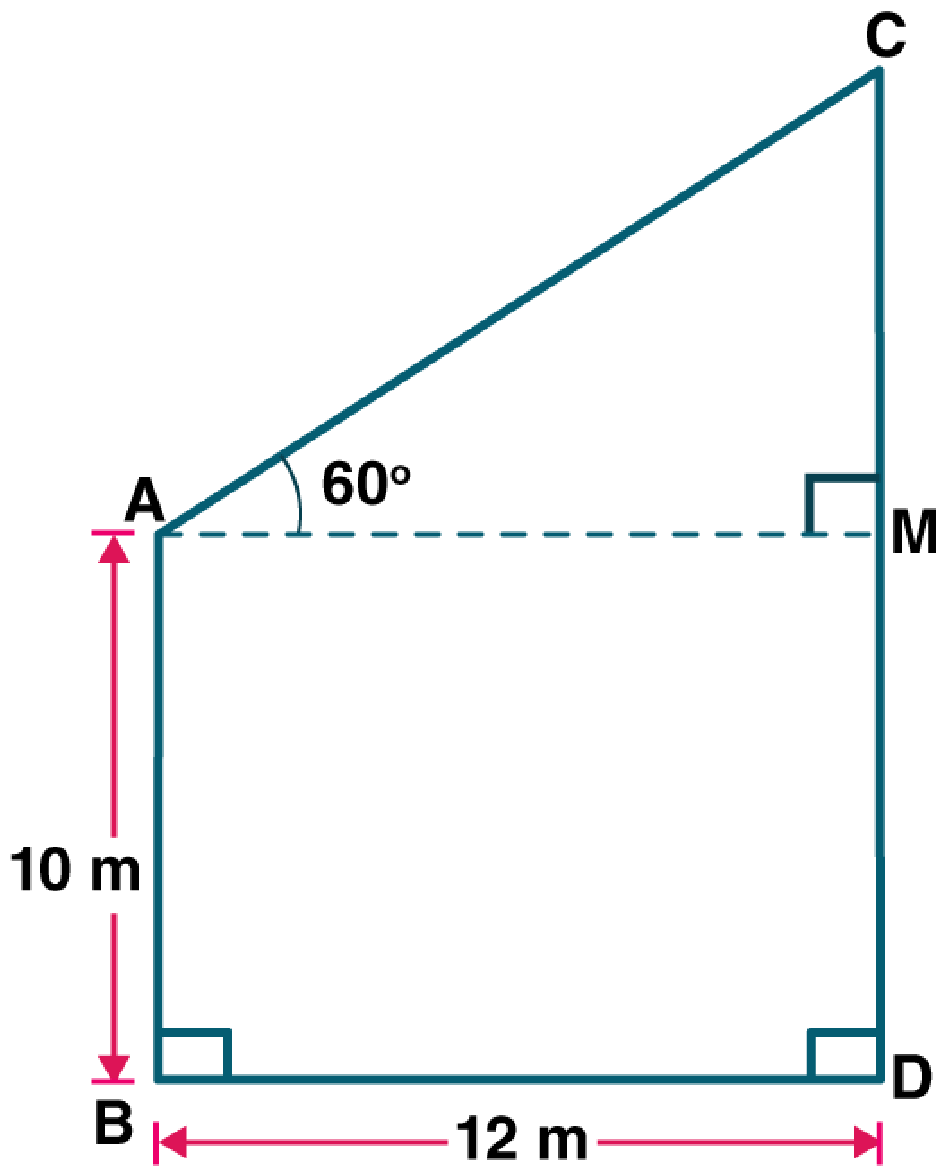
**Solution:**




Let C represent position of ship and AB represent height of the light house
Given AB = 90m
Angle of depression $\angle DAC = 60^\circ$
Here BC ∥ AD.
$\therefore \angle BCA = \angle DAC$ [Alternate interior angles]
$\therefore \angle BCA = 60^\circ$
In $\triangle ABC$ tan60 = AB/BC
$\sqrt{3} = 90/BC$
$\therefore BC = 90/\sqrt{3} = 90\sqrt{3}/3$
$= 30\sqrt{3}$
$= 30 \times 1.73$
$= 51.9$
Hence the ship is 51.9 m away from light house.

**3. Two buildings are facing each other on a road of width 12 metre. From the top of the first building, which is 10 metre high, the angle of elevation of the top of the second is found to be 60°. What is the height of the second building?**

**Solution:**




Let AB represent height of first building and CD represent height of second building.
BD is the width of the road.
Draw AM⊥CD
Given Angle of elevation ∠CAM = 60˚
Given AB = 10
BD = 12
In □AMDB , ∠D = ∠B = 90˚
Since AM⊥CD , ∠M = 90˚
∴∠A = 90˚ [Angle sum property of quadrilateral]
Since each angle equal to 90 ˚ AMDB is a rectangle.
∴Opposite sides are equal.
∴AB =MD = 10

AM = BD = 12
In△AMC, tan 60˚ = CM/AM
∴√3 = CM/12
⇒CM = 12√3 = 20.76
∴CD = CM+DM
⇒CD = 20.76 +10 = 30.76
Hence height of second building is 30.76m.

## Problem Set 6 Page 138

**1. Choose the correct alternative answer for the following questions.**
**(1) sinθ cosecθ = ?**
**(A) 1 (B) 0 (C) 1/2 (D) √2**

**Solution:**
sinθ = 1/cosecθ
∴ sinθ cosecθ =(1/cosecθ)×cosecθ = 1
Hence option A is the answer.

**(2) cosec45° =?**
**(A) 1/√2 (B) √2 (C) √3/2 (D) 2/√3**

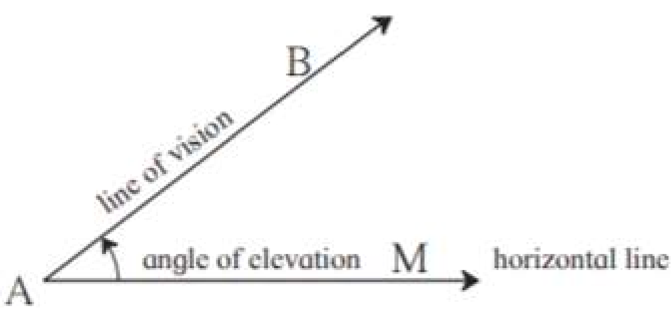
**Solution:**
cosec45 = √2
Hence option B is the answer.

**(3) 1 + $\tan^2\theta$ = ?**
**(A) $\cot^2\theta$ (B) $\text{cosec}^2\theta$ (C) $\sec^2\theta$ (D) $\tan^2\theta$**

**Solution:**
$1 + \tan^2\theta = \sec^2\theta$
Hence option C is the answer.

**(4) When we see at a higher level , from the horizontal line,angle formed is....... .**
**(A) angle of elevation. (B) angle of depression. (C) 0 (D) straight angle.**

**Solution:**




When we see at a higher level , from the horizontal line,angle formed is angle of elevation.
Hence option A is the answer.

**2. If sinθ = 11/61, find the values of cosθ using trigonometric identity.**

**Solution:**
Given sinθ = 11/61
$\sin^2\theta+\cos^2\theta = 1$ [Trigonometric identity]

$\therefore (11/61)^2+\cos^2\theta = 1$
$\therefore \cos^2\theta = 1-(11/61)^2$
= 1-121/3721
= (3721-121)/3721
= 3600/3721
Taking square root on both sides
cosθ = 60/61
Hence the value of cosθ = 60/61.

**3. If tanθ = 2, find the values of other trigonometric ratios.**

**Solution:**
Given tanθ = 2
We have $1+\tan^2\theta = \sec^2\theta$
$\therefore 1+2^2 = \sec^2\theta$
$\therefore \sec^2\theta = 5$
Taking square root on both sides
∴secθ =√5
∴cosθ = 1/secθ = 1/√5
tanθ = sinθ/cosθ
∴2 = sinθ÷(1/√5)
∴sinθ = 2/√5
cosecθ = 1/sinθ
∴coescθ = √5/2
cotθ= 1/tanθ
∴cotθ = 1/2
Hence sinθ = 2/√5, cosecθ = √5/2, cosθ = 1/√5, secθ = √5 and cotθ = 1/2

**4. If secθ = 13/12 , find the values of other trigonometric ratios**

**Solution:**
Given secθ = 13/12
∴cosθ = 1/secθ = 12/13
We have $1+\tan^2\theta = \sec^2\theta$
$\therefore 1+ \tan^2\theta = (13/12)^2$
$\tan^2\theta = (13/12)^2-1 = (169/144)-1 = (169-144)/144 = 25/144$
Taking square root on both sides
tanθ = 5/12
∴cotθ = 1/tanθ = 12/5
sinθ/cosθ = tanθ
∴sinθ = tanθ×cosθ
∴sinθ = (5/12)×(12/13)
∴sinθ = 5/13
∴cosecθ = 1/sinθ = 13/5
Hence cosθ = 12/13 , tanθ = 5/12, cotθ = 12/5 , sinθ = 5/13 and cosecθ = 13/5

**5. Prove the following.**
**(1) secθ(1 - sinθ) (secθ + tanθ) = 1**

**(2) $(\sec\theta + \tan\theta)(1 - \sin\theta) = \cos\theta$**
**(3) $\sec^2\theta + \text{cosec}^2\theta = \sec^2\theta \times \text{cosec}^2\theta$**
**(4) $\cot^2\theta - \tan^2\theta = \text{cosec}^2\theta - \sec^2\theta$**
**(5) $\tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$**
**(6) $[1/(1-\sin\theta)]+[1/(1+\sin\theta)] = 2\sec^2\theta$**

**Solution:**

(1) $\sec\theta(1 - \sin\theta)(\sec\theta + \tan\theta) = (\sec\theta - \sec\theta\sin\theta)(\sec\theta + \tan\theta)$
$= (\sec\theta - \tan\theta)(\sec\theta + \tan\theta)$ [$\sec\theta\sin\theta = \sin\theta/\cos\theta = \tan\theta$]
$= \sec^2\theta - \tan^2\theta$
$= 1$ [$1+\tan^2\theta = \sec^2\theta$]

Hence proved.

(2) $(\sec\theta + \tan\theta)(1 - \sin\theta) = [(1/\cos\theta)+(\sin\theta/\cos\theta)](1 - \sin\theta)$
$= [(1+\sin\theta)/\cos\theta]\times(1-\sin\theta)$
$= (1-\sin^2\theta)/\cos\theta$
$= \cos^2\theta/\cos\theta$
$= \cos\theta$

Hence proved.

(3) $\sec^2\theta + \text{cosec}^2\theta = (1/\cos^2\theta) + (1/\sin^2\theta)$
$= (\sin^2\theta+\cos^2\theta)/\sin^2\theta\cos^2\theta$
$= 1/\sin^2\theta\cos^2\theta$ [$\therefore \sin^2\theta+\cos^2\theta = 1$]
$= \sec^2\theta \times \text{cosec}^2\theta$

Hence proved.

(4) $\cot^2\theta - \tan^2\theta = (\text{cosec}^2\theta - 1)-(\sec^2\theta - 1)$ [$\because \cot^2\theta = \text{cosec}^2\theta - 1$ and $\tan^2\theta = \sec^2\theta - 1$]
$= \text{cosec}^2\theta - 1 - \sec^2\theta + 1$
$= \text{cosec}^2\theta - \sec^2\theta$

Hence proved.

(5) $\tan^4\theta + \tan^2\theta = \tan^2\theta(\tan^2\theta + 1)$
$= \tan^2\theta\sec^2\theta$ [$\because \tan^2\theta + 1 = \sec^2\theta$]
$= (\sec^2\theta - 1)\sec^2\theta$ [$\because \tan^2\theta = \sec^2\theta - 1$]
$= \sec^4\theta - \sec^2\theta$

Hence proved.

(6) $[1/(1-\sin\theta)]+[1/(1+\sin\theta)] = [(1+\sin\theta)+(1-\sin\theta)]/(1+\sin\theta)\times(1-\sin\theta)$
$= [1+\sin\theta+1-\sin\theta]/(1-\sin^2\theta)$
$= 2/\cos^2\theta$ [$1-\sin^2\theta = \cos^2\theta$]
$= 2\sec^2\theta$ [$\because 1/\cos^2\theta = \sec^2\theta$]

Hence proved.