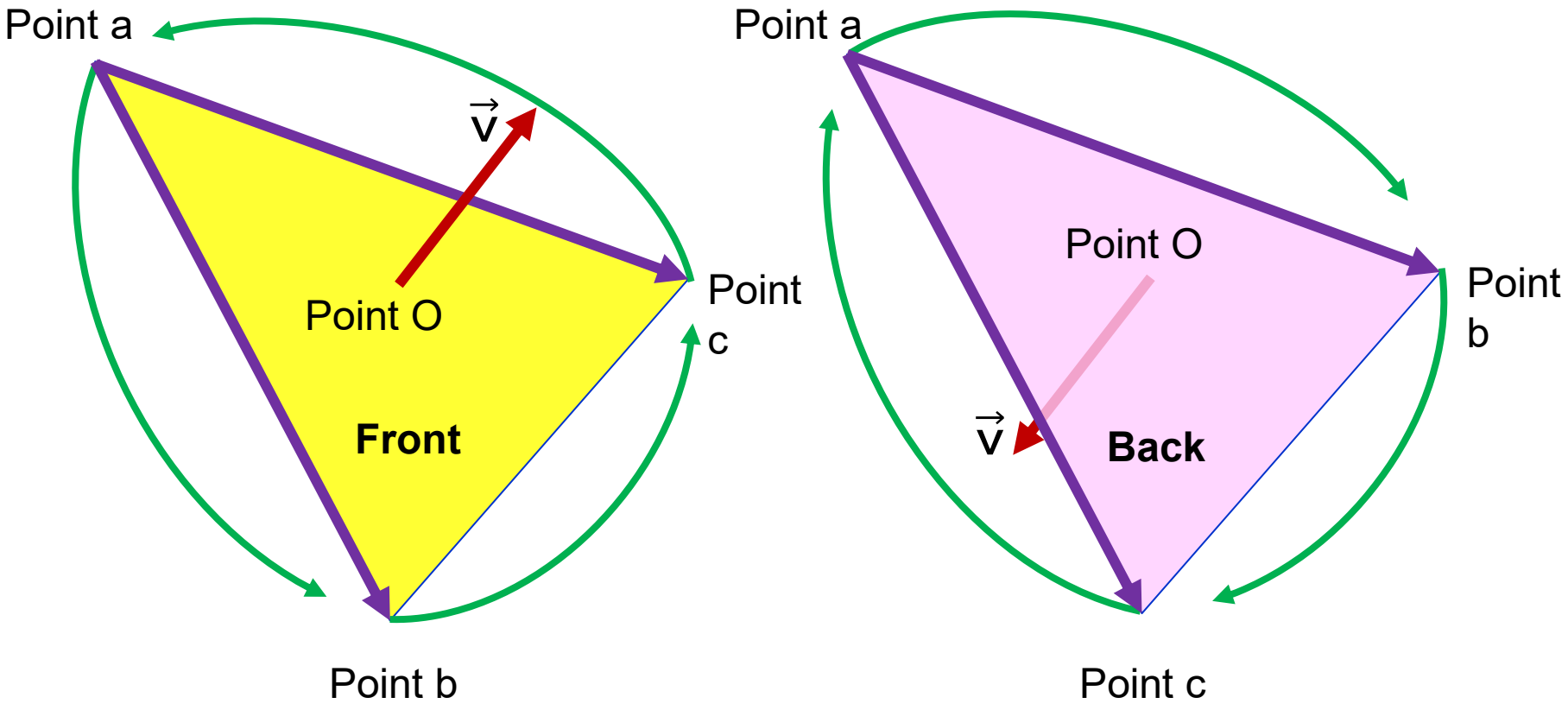
Front and back of the plane

Addendum: Numerical calculation trap

Diagnostic Imaging Practice in the Oral and Maxillofacial Region

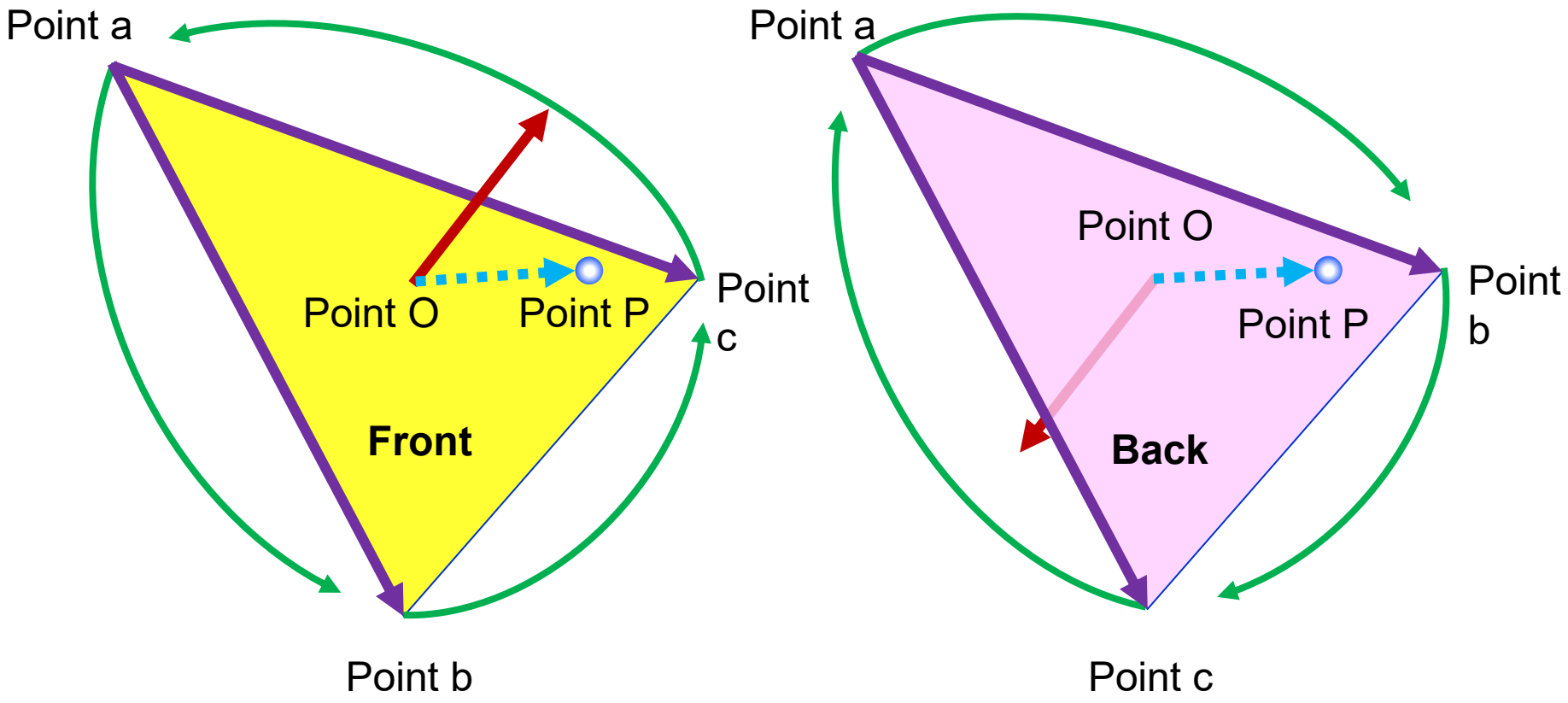
H.Nishiyama / Div. of Oral and Maxillofacial Radiology / Niigata-univ

Definition of front and back of plane



When the normal vector (v) is defined by the cross product of the ab and ac vectors, the normal vector occurs in the direction in which the order of the three points a, b, c is clockwise. The front of plane is in the same direction as the normal vector.

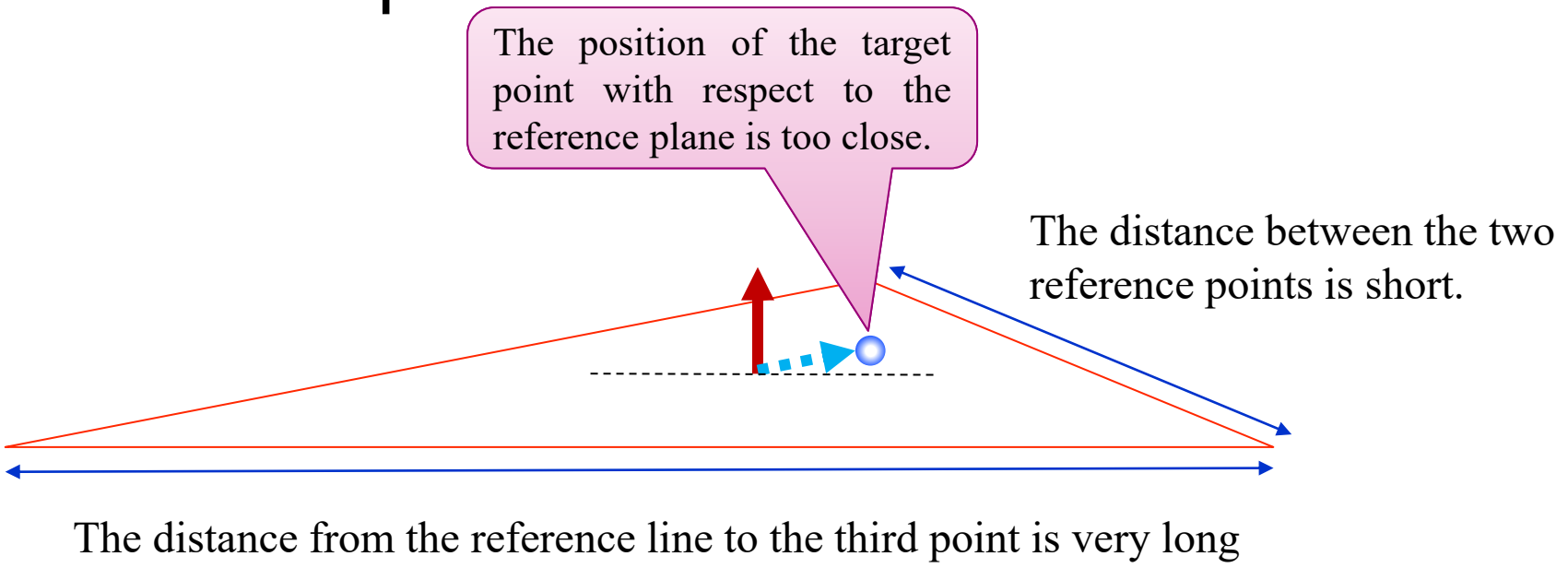
Position of point P with respect to the plane



When the angle between the OP vector and the normal vector is less than 90 degrees (the value of sin is positive), point P is located on the surface side.
When the angle between the OP vector and the normal vector is larger than 90 degrees (the value of sin is negative), point P is located on the back side.

About calculation error

- Calculation errors may occur depending on the size of the object and the positional relationship of the points.
- For example ...



Numerical calculation trap

https://github.com/aujinen/Python-note/blob/master/Riken-Nakata-Yamanaka-Magic-E.ipynb

[(18 + X) -X = ??? (Python 3.6)]

Modified C source in #26th Nakata's slide

Riken Library (Japanese)

Nakata's slide (Japanese)

In [1]:
```
### "18.0" is expressed as a floating-point number
###  Change to an integer notation such as  "18"  or another floating point number such as  "15.0" .

a=18.0
```

In [2]:
```
for i in range(45,65):
    b = 2**i #--- Enter a power of 2 (45 to 64) for "b"
    c = (a+b)-b #--- The calculation result of  "(a + b) -b"  is entered in  "c" .
    print ("a=",a,",  b = 2^",i," --> (a+b) -b = ",c," --- (a == (a+b)-b) = ",a==c)
    # Displays the value of "a", "b", "(a + b) -b" calculation result (= "c" value),
    # and "whether 'a' and 'c' are the same."
```

```
a= 18.0 ,  b = 2^ 45  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 46  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 47  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 48  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 49  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 50  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 51  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 52  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 53  --> (a+b) -b =  18.0  --- (a == (a+b)-b) =  True
a= 18.0 ,  b = 2^ 54  --> (a+b) -b =  16.0  --- (a == (a+b)-b) =  False
a= 18.0 ,  b = 2^ 55  --> (a+b) -b =  16.0  --- (a == (a+b)-b) =  False
a= 18.0 ,  b = 2^ 56  --> (a+b) -b =  16.0  --- (a == (a+b)-b) =  False
a= 18.0 ,  b = 2^ 57  --> (a+b) -b =  32.0  --- (a == (a+b)-b) =  False
a= 18.0 ,  b = 2^ 58  --> (a+b) -b =  0.0  --- (a == (a+b)-b) =  False
```

If the numerical calculation is repeated between a large absolute value and a small absolute value, the small number itself is considered to be zero or treated as a value that is about twice as different.