**Useful formulas for BECE candidates to note. Please Note: We do not GIVE MARKS for formulas stated, but a solution with A WRONG formula will LOSE VITAL marks.**

1. Number of subsets of a given set $= 2^n$, where n is number of elements in the set

2. A∩B = elements in both sets A and B.

3. AUB = Collection of elements in sets A and B without repeating common elements.

4. $(AUB)^1$ = Elements in the Universal set which are not in AUB. Note in a Venn diagram, these elements are always outside the two intersecting circles.

5. Note the use of BODMAS: Brackets, of, division, multiplication, addition and subtraction.

6. $a^m \times a^n = a^{m+n}$. E.g $5^6 \times 5^4 = 5^{6+4} = 5^{10}$.

7. $a^m \div a^n = a^{m-n}$. E.g $\dfrac{5^6}{5^4} = 5^6 \div 5^4 = 5^{6-4} = 5^2$.

8. (a+b) (c+d) = a(c+d) +b(c+d)

9. $x^2 - y^2 = (x - y)(x + y)$

10. To convert a number from base ten to other base, use the table method.

11. To convert a number from a non- decimal base to another non-decimal base. Convert the first non-decimal base to base ten, then convert the base ten to the desired base. E.g Convert $1101_2$ to base 5.

12. Profit = S.p - C.p

13. Loss = C.p – S.p

14. Profit percent(%) $= \dfrac{Profit}{C.p} \times 100$

15. Loss % $= \dfrac{Loss}{C.p} \times 100$

16. Finding C.p given S.p and Profit percent : C.p $= \dfrac{100}{100+P\%} \times S.p$

17. Finding S.p given C.p and Profit percent : S.p $= \dfrac{100+profit\%}{100} \times C.p$

18. Finding C.p given S.p and LOSS%: C.p $= \dfrac{100}{100-loss\%} \times S.p$

19. Finding S.p given C.p and LOSS%: S.p $= = \dfrac{100-loss\%}{100} \times C.p$

## DISCOUNT

20. New price = Marked price – Discount

   Or New price = $\frac{100-Discount\%}{100} \times marked\ price.$

21. Marked price = New price + discount

   Or Marked price = $\frac{100}{100-Discount\%} \times new\ price$

22. Discount = marked price – New price.

Or Discount/ amount saved = $\frac{Discount\%}{100} \times marked\ price$

## COMMISSION

23. Commission = Commission rate x total sales

24. Total earnings = basic salary + Commission

## INTEREST

25. Interest(Simple interest) = $\frac{Principal \times rate \times Time(should\ be\ in\ years)}{100}$

26. Total amount = Principal + interest

27. Monthly installment = $\frac{Amount\ to\ be\ paid(P+I)}{Total\ number\ of\ months}$

## VALUE ADDED TAX(VAT)

28. VAT = $\frac{vat\ rate}{100} \times$ BASIC cost

29. VAT = $\frac{VAT\ rate}{100+VAT\ rate} \times$ VAT inclusive cost. This formula is used when Vat inclusive cost is given. These formulas also apply to NHISL. Just replace VAT with NHISL.

30. $a:b = \frac{a}{b}$, also : $a:b = c:d \Rightarrow \frac{a}{b} = \frac{c}{d}$

31. Scale = Map distance : Actual distance , Scale is mostly in the form: **1 :n**

32. Map distance = $\frac{Actual\ distance}{n}$

33. Actual distance = n x map distance.

34. Average speed $= \dfrac{Total\ distance}{time\ taken}$

35. Distance = Average speed x time taken

36. Time taken $= \dfrac{Distance}{average\ speed}$

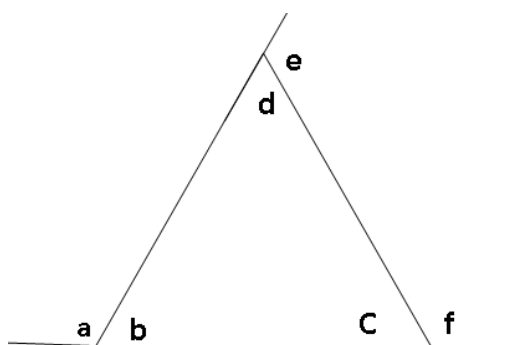37. Tax free income = sum of all non-taxable allowances

38. Taxable income = Salary − Total tax free

39. Tax = rate of tax × amount to be taxed.

40. Net income ( take home pay) = salary − total deductions

Note : Deductions include but not limited to: tax, Social security, loans, dues.
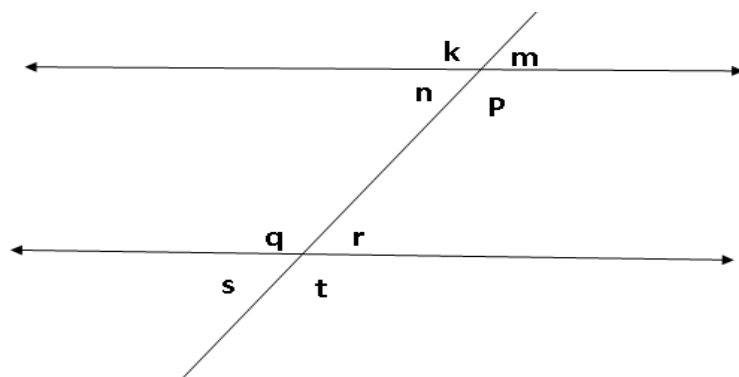
41.



From the diagram: An exterior angle is equal to the sum of the two opposite interior angles.

**a=c+d**

**e= b +c**

**f = b+d**

42.



**Corresponding angles**
k= q,   n=s,   m=r,   p= t
**Alternate angles**
n=r,   p=q
**Co- interior angles ( adds up to $180^0$)**
 $n+q = 180^0$

$p+r = 180^0$

$k+m+n+p = 360^0$, angles around a point.

43. Area of square = $l^2$, perimeter of square = $4l$

44. Area of rectangle = $l \times b$, perimeter of rectangle = $2(l + b)$

45. Area of parallelogram = Length of base x perpendicular height

Perimeter of parallelogram = 2 x length of base + 2 x the other side

46. Area of trapezium = $\frac{1}{2}$ ×( sum of parallel sides) x height, Perimeter of trapezium =

   sum of all 4 sides.

47. Area of rhombus = $\frac{1}{2}$ × product of diagonals, perimeter of rhombus = 4$l$

48. Area of kite = $\frac{1}{2}$ × product of diagonals, Perimeter of kite = Sum of the 4 sides.

49. Area of triangle = $\frac{1}{2}$ × base x height, Perimeter of triangle = sum of three sides

50. Circumference of circle = $\pi d$ $or$ $2\pi r$

51. Area of circle = $\pi r^2$, area of **semi**-circle = $\frac{1}{2}\pi r^2$, area of **quadrant** = $\frac{1}{4}\pi r^2$

52. Length of arc of a circle = $\frac{\theta}{360^0} \times 2\pi r$

53. Area of sector = $\frac{\theta}{360^0} \times \pi r^2$

54. Perimeter of sector = $2r + \frac{\theta}{360^0} \times 2\pi r$

55. Total surface area of a cylinder = $2\pi r(r + h)$

56. Total surface area of a cylinder with one end open or one end closed = $\pi r(r + h)$

57. Curved surface area of a cylinder = $2\pi rh$

58. Volume of cylinder = $\pi r^2 h$

59. Area of cuboid/rectangular box or tank = $2[lb + lh + bh]$

60. Volume of cuboid = $l \times b \times h$

61. Total surface area of a cone = $\pi r(r + l)$.      Note:$l$ = slant height.

62.Curved surface area of a cone = $\pi rl$

63. Volume of cone = $\frac{1}{3}\pi r^2 h$

64. Volume of Pyramid = = $\frac{1}{3}$ × base area x height

65. Area of a sphere = $4\pi r^2$

66. Volume of sphere $= \frac{4}{3}\pi r^3$

67. Area of prism = area of its net

68. Volume of prism = area of cross section x length

69.  p+ q = q+ p →Commutative property

70. p+ (q+r) = (p+q) +r → Associative property

71. p(q+r) = pq + pr→ Distributive property

72. $y = mx + c$     E.g  $y = 5x + 6$. Gradient = 5.
    ↙        ↘ y- intercept
  Gradient

73. Gradient = m = $\frac{y_2 - y_1}{x_2 - x_1}$

74. length of a line joining two points = Distance between two points =
    $$\sqrt{(x_2 - x_1)^2 - (y_2 - y_1)^2}$$

75. Equation of a line formula: $y - y_1 = m(x - x_1)$, where  m = gradient.

76.  Back bearing:  If the bearing of Zorko from Bolga is $\theta$, then the reverse or the bearing of Bolga from Zorko is

   a) $\theta + 180^0$ , $if \ \theta < 180^0$

   b) $\theta - 180^0$  $if \ \theta > 180^0$. Note: $\theta$ is the angle given in the question.

77.     $\binom{p}{q} + \binom{r}{s} = \binom{p + r}{q + s}$

78.     Probability of an event$= \frac{Number \ of \ ways \ event \ can \ occur}{total \ number \ of \ possible \ outcomes}$

   a) Sample space of tossing a coin once $= 2^1 = 2 = $ { H, T}

   b) Sample space of tossing a coin twice $= 2^2 = 4 = $ { HH,HT,TH, TT}

   c) Sample space of tossing a coin thrice $= 2^3 = 8 = $

|     | HH  | HT  | TH  | TT  |
| --- | --- | --- | --- | --- |
| H   | **HHH** | **HHT** | **HTH** | **HTT** |
| T   | **THH** | **THT** | **TTH** | **TTT** |

**Embassy Mathematics formula book.**

**Embassy Mathematics: YOUR GATE WAY TO SUCCESS IN MATHEMATICS**

d) Sample space of tossing a ludu die once $= 6^1 = 6 = \{1, 2, 3, 4, 5, 6\}$

e) Sample space of tossing a die twice $= 6^2 = 36 =$

|   | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | **1,1** | **1,2** | **1,3** | **1,4** | **1,5** | **1,6** |
| 2 | **2,1** | **2,2** | **2,3** | **2,4** | **2,5** | **2,6** |
| 3 | **3,1** | **3,2** | **3,3** | **3,4** | **3,5** | **3,6** |
| 4 | **4,1** | **4,2** | **4,3** | **4,4** | **4,5** | **4,6** |
| 5 | **5,1** | **5,2** | **5,3** | **5,4** | **5,5** | **5,6** |
| 6 | **6,1** | **6,2** | **6,3** | **6,4** | **6,5** | **6,6** |

f) Sample space of tossing a coin and a die $= 2\text{x}6 = 12$

|   | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| H | **H,1** | **H,2** | **H,3** | **H,4** | **H,5** | **H,6** |
| T | **T,1** | **T,2** | **T,3** | **T,4** | **T,5** | **T,6** |

79.     Mode = most occurring number **or** number with the highest frequency in the case of a frequency table.

    Median = Middle number after the data is arranged in ascending order. Note how to find median in a frequency table.

80.     Mean $= \frac{\Sigma x}{n}$, without a frequency table or **Mean** $= \frac{\Sigma fx}{\Sigma f}$, finding mean from a frequency table

81. Reflection in x- axis or the line y= 0: $(x,y) \rightarrow (x,-y)$

82. Reflection in the y-axis or x= 0: $(x,y) \rightarrow (-x,y)$

83.Rotation through $90^0$ clockwise about the origin. $(x,y) \rightarrow (y,-x)$

84. Rotation via $90^0$ anticlockwise about the origin: $(x,y) \rightarrow (-y,x)$

85. Rotation via $180^0$ about the origin( clockwise or anticlockwise): $(x,y) \rightarrow (-x,y)$

86. Rotation via $270^0$ clockwise about the origin: $(x,y) \rightarrow (-y,x)$

87. Rotation via $270^0$ anticlockwise about the origin: $((x,y) \rightarrow (y,-x)$

88. Translation: Image = point +vector. Remember to write image in row form but not as column form.

89. Enlargement with scale factor k: $(x, y) \rightarrow (kx, ky)$.

90. Sum of interior angle of a polygon $= (n - 2) \times 180^0$

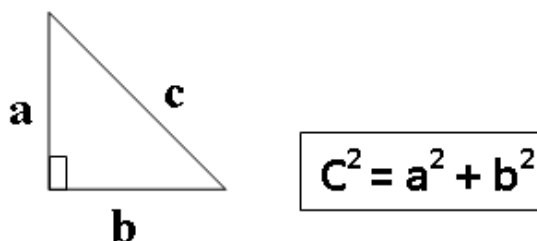91. Interior angle of a regular polygon $= \dfrac{(n-2) \times 180^0}{n}$

92. Exterior angle of a regular polygon $= \dfrac{360^0}{n}$

93. Scale factor of an enlargement or reduction $= \dfrac{image\ length}{Corresponding\ object\ length}$

94. $k^2 = \dfrac{area\ of\ enlarged\ figure}{area\ of\ original\ figure}$

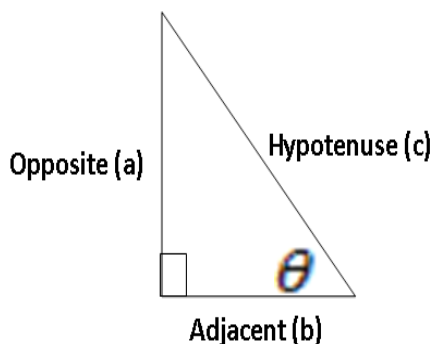95. $k^3 = \dfrac{volume\ of enlarged\ figure}{volume\ of\ original\ figure}$

96. Pythagoras theorem:

$$C^2 = a^2 + b^2$$

97. Pythagorean triples: 3 set of numbers which obey the Pythagoras theorem

{3,4,5} {5,12,13} {6,8,10},{8,15,17}

98. Trigonometric ratios: applies to only right angle triangle.

Opposite (a)    Hypotenuse (c)

$\theta$

Adjacent (b)

Using the shortcut: SOHCAHTOA

$$Sin\theta = \frac{Opposite}{hypotenuse} = \frac{a}{c}$$

$$Cos\theta = \frac{adjacent}{hypotenuse} = \frac{b}{c}$$

$$Tan\theta = \frac{opposite}{adjacent} = \frac{a}{b}$$

99. Net of solid figures.

Net of cylinder

Net of cone

Net of square or rectangular pyramid

Net of cuboid

Net of triangular pyramid