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## Marine Engineering Exam Resource – Review of Mathematics

### Area

- Area of a square equals?
  - Area = Side x Side
- Area of a rectangle equals?
  - Area = Length x Width
- Area of a triangle equals?
  - Area =  $\frac{1}{2}$  Base x Height
- Area of a circle equals?
  - Area = Pie x R squared
    - = Pie x Diameter / 4
- Perimeter of a square equals?
  - Perimeter = Length + Width + Length + Width
  - Sums of all sides.  $P = 4 \times \text{side}$
- Perimeter of a rectangular equals?
  - Sum of sides.  $P = (L + W) \times 2$
- Circumference of a circle equals?
  - Circumference = Pie x Diameter.
- Volume of a cube equals?
  - Volume =  $L \times W \times H$                       cube equals measurement
- Volume of a rectangle equals
  - Volume =  $L \times W \times H$                       cube equals measurement
- Volume of a cylinder equals
  - Volume = Pie x R squared x H      cube equals measurement

### RATIOS

1. What is a ratio?  
Comparison of two numbers or values. Example 5:1 input : output Page 203
2. What is proportion?  
Comparison of two ratios. 3:4 compared to 6:8
3. What is direct proportion?  
Increase in one value resulting in an increase of another value.
4. What is indirect proportion?  
Increase in one value is result in decrease in another value.

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Pulley size to rpm      Large pulley size decreases in rpm.

5. What is the area of a rectangle 12" long 6" wide, a) in square inches, b) square feet, c) square yards?
6.  $A = L \times W$       Square feet = 72 square inches / ( 12 x 12 square feet) = .5 square feet  
 $12 \times 6 = 72$  square inches
7. The side of a square is 9" a) what is its perimeter? b) What is its area?  
 $P = 4 \times 9$        $P = 36"$     $A = L \times W = 9 \times 9 = 81$  Square inches
8. What is the decimal equivalent of 7/8 and 9/16?  
 $7/8 = .875$        $9/16 = .562$
9. How many square feet of material are needed to build a cylindrical tank 15 feet high which has a 9-foot diameter and an open top?  
 $C = \text{Pie} \times D$       Side area =  $15 \times 28.27 = 424$   
 $= 3.14 \times 9$       bottom =  $A = \text{Pie} \times R \text{ squared}$   
 $= 28.27'$       = 63.62  
 Total square feet = 487.62 square feet.
10. An 8" and a 10" emery wheel are on the same shaft. If the grinding wheel speed of the 10" wheel is 4800 surface feet per minute, what is the grinding speed of the 8" wheel?  
 $4800 / 10 = 480 \times 8 = 3840$   
 $8/10 = x / 4800 = 8 \times 4800 / 10 = 3840$  ft / minute.
11. What is the circumference of a circle with a diameter of a) 7" b) 14" c) 21" d) 35" e) 2.8"?  
 $C = \text{Pie} \times D = \text{Pie} \times 7" = 21.99"$   
 $C = \text{Pie} \times D = \text{Pie} \times 14" = 43.98"$   
 $C = \text{Pie} \times D = \text{Pie} \times 21" = 65.97"$   
 $C = \text{Pie} \times D = \text{Pie} \times 35" = 109.96"$   
 $C = \text{Pie} \times D = \text{Pie} \times 2.8 = 8.80"$
12. What is the diameter of a circle if it's circumference is a) 3.14 b) 31.3 c) 62.8 d) 9.42.  
 $D = C / \text{Pie} = 3.14 / 3.14 = 1$        $D = C / \text{Pie} = 31.3 / 3.14 = 9.97"$   
 $D = C / \text{Pie} = 62.8 / 3.14 = 20.00$     $D = C / \text{Pie} = 9.42 / 3.14 = 2.49$
13. How much belt passes over a 12 " pulley in 3 revolutions if there is no slippage?  
 $C = \text{Pie} \times \text{Diameter}$        $3.14 \times 12" = 37.70"$        $37.70" \times 3 = 113.097"$
14. A 20-foot ladder is required to reach a window 16 feet above the ground. What length of ladder would be required if the window were 25 feet up?  
 $20 / 16 = 1.25$        $1.25 \times 25 = 31.25$

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15. A motor driven with a 6" driver pulley rotates at 1200 driven side R.P.M. It drives a generator with an 8" driven pulley. Find the R.P.M. of the generator.  
Driver / Driven = Driven / Driver  $6 / 8 = x / 1200$   
 $6 \times 1200 / 8 = 900$  R.P.M.
16. What is the volume of a box which is 8" x 5" x 2" ?  
Vol = L x W x H =  $8 \times 5 \times 2 = 80$  inches cubed
17. What volume of earth must be removed for a basement 24' by 15' by 6'6" deep?  
Volume = L x W x D =  $24 \times 15 \times 6.5' = 2340$  ft cubed
18. A motor rotates at 1730 R.P.M. (driver) Find the size of the motor pulley required to turn a grinding wheel at 3000 R.P.M. (driven) through a 1.750" diameter pulley?  
Driver / Driven = Driven / Driver  $1730 / 3000 = 1.750 / x = 3000 \times 1.750 / 1730 = 3.034$ "  
Diameter
19. A concrete column is 18 inches in diameter and 12 feet high. How many cubic yards of concrete does it contain?  
V = Pie x Radius squared x length  
If concrete weighs 150 lbs. per cubic foot, find the weight of the column in question 28.  
 $x 150 = 3180.86$  lb.
20. What would the pressure in PSI be on the soil below the above concrete column?  
Force = 3180.86 lb.  
A = Pie R squared = Pie x 9 squared = 254.47  
divided by 254.47 = 12.50 PSI
21. A gear with teeth turns at 500 RPM. What is the number of teeth required on a gear to be driven at 200 RPM?  
Driver divided by Driven = Driven divided Driver  
 $500 / 200 = x / 80 = 500 \times 80$  divided by 200 = 200 teeth.
22. A pulley rotates at 450 RPM driving pulley B with a diameter 15", pulley C with an 18" diameter, drives D with a diameter at 1350 RPM. Find the diameter of A. Pulley B & C are on the same shaft.  
Pulley A = 450 RPM driver  
Pulley B = 15 Diameter Driven  
Pulley C = 18 Diameter Driver  
Pulley D = 10 Diameter Driven  
1350 RPM  
Driver divided by Driven = Driven divided Driver  $18" / 10 = 1350 / X$  X= 750  
Driver divided by Driven = Driven divided Driver  $X / 15 = 750 / 450$  X = 25"  
Diameter of A is 25"
23. A 10" diameter pulley turning at 1200 RPM drives a 20" pulley on a jackshaft. The same jackshaft is a 15" pulley driving a 30" pulley. What is the value of the following?  
Ratio of the pulley size ( first drive )

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10: 20 Ratio 1:2

24. Speed of the jackshaft.

Driver divided by Driven = Driven divided Driver

$$10 / 20 = X / 1200 = 600 \text{ RPM}$$

25. Ratio of pulley speeds ( first drive )

$$1200: 600 = 2:1$$

26. Ratio of the pulley sizes ( second drive )

$$15:30 \text{ Ratio } 1:2$$

27. Speed of the final shaft

Driver divided by Driven = Driven divided Driver

$$15 / 30 = X / 600 = 300 \text{ RPM}$$

28. Ratio of pulley speeds ( 2nd drive )

$$600 = 300 \text{ } 2:1 \text{ Ratio}$$

29. Ratio of speeds, input shaft to output shaft.

$$1200:300 \text{ Ratio } 4:1m.$$