10 Math Problems

Learning Outcomes:

☑ Demonstration of practical application of mathematics as it relates to the job
This section of the guide provides you with the equations and practice exercises to assist you in your work.

### Definitions

- **L** = Length of spread in feet
- **R** = Rate of application (asphalt in gallons per sq. yd. or aggregate in lb. per sq. yd.)
- **W** = Width of roadway
- **T** = Total gallons or pounds

### Useful Formulas

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( L = \frac{9 \times T}{W \times R} )</td>
<td>To find length of spread</td>
</tr>
<tr>
<td>( L = \frac{9 \times 2000}{W \times R} )</td>
<td>To find length of spread per ton</td>
</tr>
<tr>
<td>( R = \frac{9 \times T}{W \times L} )</td>
<td>To find rate of application for asphalt or aggregate</td>
</tr>
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</table>
Determining Length of Spread

**Formula**

\[
L = \frac{9 \times T}{W \times R}
\]

**Example:**

- Application rate = 170 lb/yd²
- Total weight shipped = 132,940 lb
- Pavement width = 26 feet

\[
L = \frac{9 \times 132,940}{26 \times 170} = \frac{1,196,460}{4420} = 270.69 \text{ or } 270.70 \text{ linear feet}
\]

How many feet per ton will this material cover?

**Formula**

\[
\frac{9 \times 2000}{W \times R} = \frac{18,000}{26 \times 170} = \frac{1,800}{4,420}
\]

\[
L = 4.07 \text{ or } 4.1 \text{ linear feet per ton}
\]

2000 lbs = 1 ton
Paving Math Problems

1. Using the information below:
   a. Calculate the linear feet this truckload of AC should cover at the specified application rate.
   b. How many linear feet will each ton of AC pave?

   Application Rate = 185 lb./yd²
   Total weight shipped = 33,135 lb.
   Pavement width = 11 feet

2. Using the information below:
   a. Calculate the linear feet this truckload of AC should cover at the specified application rate.
   b. How many linear feet will each ton of AC pave?

   Application Rate = 165 lb./yd²
   Total weight shipped = 127,580 lb.
   Pavement width = 24 feet

3. Using the information below:
   a. Calculate the linear feet this truckload of AC should cover at the specified application rate.
   b. How many linear feet will each ton of AC pave?

   Application Rate = 158 lb./yd²
   Total weight shipped = 46,778 lb.
   Pavement width = 12 feet
## Determining Application Rate

### Formula

\[ R = \frac{9 \times T}{W \times L} \]

### Example:

The contractor has uniformly applied 495 gallons of undiluted CRS-1 emulsion to a section of roadway for a tack coat. It covers 5750 linear feet of roadway at a width of 13 feet.

- What is the application rate of the tack coat?
- Does it meet the specification requirement?

(See VDOT Road & Bridge Spec. 310.03)

* Diluted spec= 0.10 to 0.15, Non-diluted spec=0.05 to 0.10

\[ R = \frac{4,455}{7,4750} = 0.059 \text{ or } 0.06 \text{ gal/yd}^2 \]
Paving Math Problems

4. The Contractor has uniformly applied **610** gallons of undiluted CRS-1 emulsion to a section of roadway for a tack coat. The tack covers **5250** linear feet in length at a width of **11** feet.
   a. What is the application rate of the tack coat? ________________ gal/yd$^2$.
   b. Does this meet specification?

5. The Contractor has uniformly applied **2154** gallons of undiluted CRS-1 emulsion to a section of roadway for a tack coat. The tack covers **38,016** linear feet in length at a width of **12** feet.
   a. What is the application rate of the tack coat? ________________ gal/yd$^2$.
   b. Does this meet specification?

6. The Contractor has uniformly applied **3320** gallons of undiluted CRS-1 emulsion to a section of roadway for a tack coat. The tack covers **29,040** linear feet in length at a width of **12** feet.
   a. What is the application rate of the tack coat? ________________ gal/yd$^2$.
   b. Does this meet specification?
Placement Limitations

Section 315.04 of the Road and Bridge Specifications provide for the placement limitations of hot mix asphalt. Table III-2, also called the nomograph, is used to determine the minimum laydown temperature for a mix at a specific rate of application using either the 8-minute maximum breakdown rolling time (using two rollers) or the 15 minute maximum breakdown rolling time (using 1 roller), at a specific base temperature.

Asphalt Concrete Paving Limitations

- Minimum Laydown Temp. (°F)
- Rate of Application (lbs per sq. yd)
- 8-Minute Max. Breakdown Time Using 2 Rollers
- 15-Minute Max. Breakdown Rolling Time Using 1 Roller
- Base Temp. (°F)
7. A load of IM-19.0A arrived at the project to be placed at 220 lb./yd.\(^2\) with one breakdown roller on the job and a base temperature of 50°F, what is the minimum laydown temperature?

   a. 250°F  
   b. 304°F  
   c. 295°F  
   d. 353°F

8. A load of SM-12.5A arrived at the project to be placed at 175 lb./yd.\(^2\) with two breakdown rollers on the job and a base temperature of 40°F, what is the minimum laydown temperature?

   a. 330°F  
   b. 338°F  
   c. 250°F  
   d. 289°F

9. A load of SM-12.5A arrived at the project to be placed at 185 lb./yd.\(^2\) with one breakdown roller on the job and a base temperature of 45°F, what is the minimum laydown temperature?

   a. 300°F  
   b. 318°F  
   c. 287°F  
   d. 307°F

10. A load of IM-19.0A arrived at the project to be placed at 190 lb./yd.\(^2\) with two breakdown rollers on the job and a base temperature of 52°F, what is the minimum laydown temperature?

    a. 308°F  
    b. 338°F  
    c. 281°F  
    d. 274°F

11. The 8 minute maximum breakdown rolling time is specified when 2 or more rollers are used in breakdown rolling.

    a. True  
    b. False