### 25. \( \sqrt{2} \)

#### 1. Sky Diver jumps. \( v(t) = 90 \left( 1 - e^{-0.25t} \right) \)
   
   (a) Initial velocity.
   (b) vel. after 8 sec. (round to 2 dec. then to 0)

   **Solution**
   
   (a) \( v(t) = 90 \left( 1 - e^{-0.25 \cdot 0} \right) = 90 (1 - 1) = 0 \)
   
   (b) \( v(t) = 90 \left( 1 - e^{-0.25 \cdot 8} \right) \)
   
   \[ 77.819 \text{ ft/sec} \approx 77.8 \text{ ft/sec} \]

#### 2. Answers:

- The initial velocity is 0 ft/sec, and the velocity after 8 sec is approximately 77.8 ft/sec.

### 26.

#### 4. Solve: \( \log_a (x-2) + \log_a (x+4) = 3 \)

**Solution**

\[ \log_a [(x-2)(x+4)] = 3 \]

- \( x^2 + x - 12 = 8 \)
- \( x^2 + x - 20 = 0 \)

**3.** Now solve by factoring: \( (x+5)(x-4) = 0 \)

- If \( x = -5 \) or \( x = 4 \)

**4.** But -5 doesn't "work" in \( (*) \):

\[ \log_a (-5-3) \text{ does not exist} \]

Thus, \( x = 4 \) does work.

#### 5. Earthquake:

- Indonesia: \( M_s = 9.0 \)
- Macquarie: \( M_m = ? \)

**Find \( M_m \):**

\[ M_m \approx 6.2 \]

**3.** The magnitude of the Macquarie earthquake of 4/16/07 is approximately 6.2 on the Richter scale.

#### 6. Find the (a) focus, (b) directrix, (c) focal diameter. \( x = \frac{1}{2} \)

**Solution**

\[ y^2 = 2x \text{ std. Form.} \]

- \( p = 2 \)

**3.** The parabola is horizontal & it opens to the right.

**3.** \( F( \frac{1}{2}, 0) \)

The directrix is \( x = -\frac{1}{2} \) and the sol. = \{4p - 2\}.
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Vertex @ (0,0), Focus on y-axis, 2a = 8


Sol. 1  
\[ f_1d = 8 \quad f_1 = \frac{4p}{1} \quad b = \frac{1}{4p} \]

and parabola opens upward; \( |4p| = 4p \), So \( 4p = 8 \)

So \( p = 2 \)

2. Parabola is vertical, so \( F(0,2) \), directrix \( y = -2 \)

and eq. is \( x^2 = 4py \) (vertical), so \( x^2 = 8y \)

2.

The equation is \( x^2 = 8y \); the focus is \( F(0,2) \) and the equation of the directrix is \( y = -2 \).

**BONUS**

Graph and label vertices, focus, y-intercepts.

\[ 4x^2 + 9y^2 = 36 \]

Sol. 1  
\[ \frac{x^2}{9} + \frac{y^2}{4} = 1 \] is std. form.

\( a^2 = 9 \) and \( b^2 = 4 \) thus \( c^2 = a^2 - b^2 = 9 - 4 = 5 \)

so \( c = \sqrt{5} \). \( \text{And } a = 3, b = 2 \)

Note: \( \text{L.R.} = \frac{2b^2}{a^2} = \frac{5}{3} \)

[Diagram of an ellipse]

Also, if \( x = 1 \) \( y^2 = 4, \frac{8}{3} = \frac{32}{9}, \) so \( y = \pm \frac{4}{3} \).