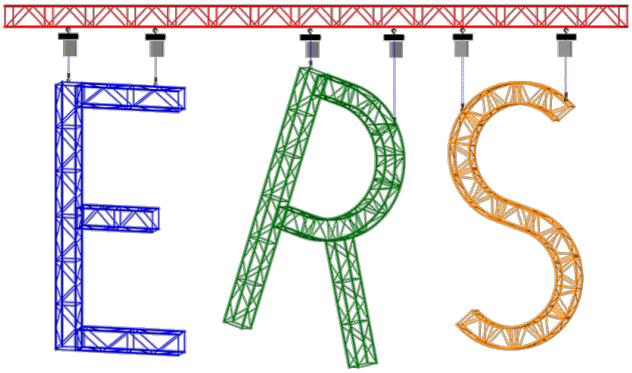


ENTERTAINMENT

RIGGING SESSIONS

Math Workbook Answer Guide

Hardware: Reduction of Strength

Shock Loads

- 4000lbs on two 1ton motors
- 5’ GAC safety with a W.L.L. of 2800lbs THROUGH center of truss
- Truss drops 15” before safety takes load
- Truss stops in 1”

$$ShockLoadForce = 2000(1 + \frac{FreeFallDistance}{StoppingDistance})$$

ENTERTAINMENT RIGGING SERVICES, LLC

Hardware: Reduction of Strength

Shock Loads

- 4000lbs on two 1ton motors
- 5’ GAC safety with a W.L.L. of 2800lbs THROUGH center of truss
- Truss drops 15” before safety takes load
- Truss stops in 1”

$$ShockLoadForce = 2000(1 + \frac{15}{StoppingDistance})$$

ENTERTAINMENT RIGGING SERVICES, LLC

Hardware: Reduction of Strength

Shock Loads

- 4000lbs on two 1ton motors
- 5’ GAC safety with a W.L.L. of 2800lbs THROUGH center of truss
- Truss drops 15” before safety takes load
- Truss stops in 1”

$$ShockLoadForce = 2000(1 + \frac{15}{1})$$

ENTERTAINMENT RIGGING SERVICES, LLC

Hardware: Reduction of Strength

Shock Loads

- 4000lbs on two 1ton motors
- 5’ GAC safety with a W.L.L. of 2800lbs THROUGH center of truss
- Truss drops 15” before safety takes load
- Truss stops in 1”

$$ShockLoadForce = 2000(16)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Hardware: Reduction of Strength

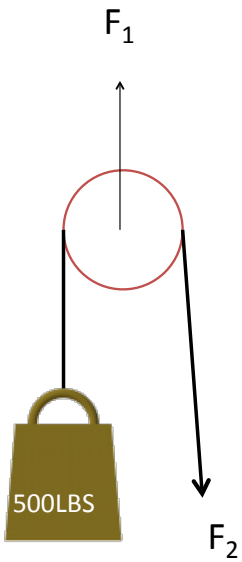
Shock Loads

- 4000lbs on two 1ton motors
- 5’ GAC safety with a W.L.L. of 2800lbs THROUGH center of truss
- Truss drops 15” before safety takes load
- Truss stops in 1”

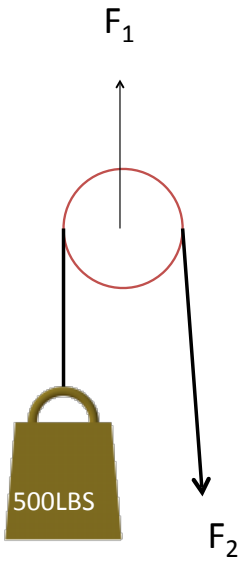
$$ShockLoadForce = 32,000LBS$$

Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$



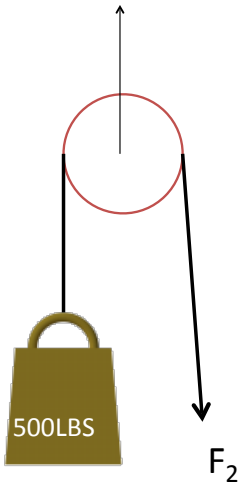
Block and Fall



$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Block and Fall

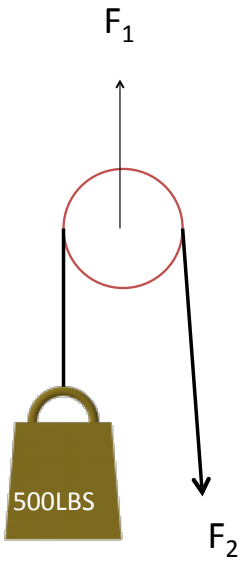


$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{2}{1}(500)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Block and Fall



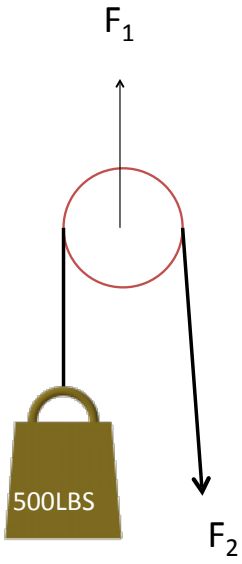
$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{2}{1}(500)$$

$$F_1 = 1000LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Block and Fall



$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

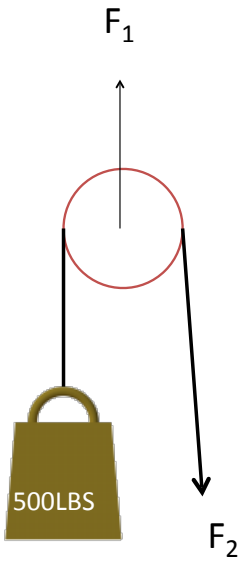
$$F_1 = \frac{2}{1}(500)$$

$$F_1 = 1000LBS$$

$$F_2 = \frac{FA}{NumberOfLinesOnRunningBlock}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Block and Fall



$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{2}{1}(500)$$

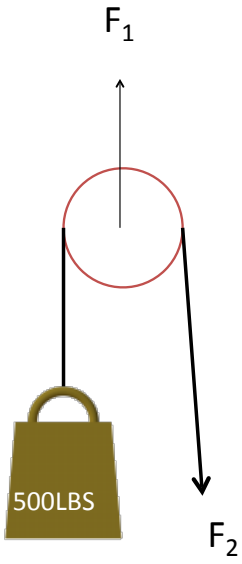
$$F_1 = 1000LBS$$

$$F_2 = \frac{FA}{NumberOfLinesOnRunningBlock}$$

$$F_2 = \frac{500}{1}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Block and Fall



$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{2}{1}(500)$$

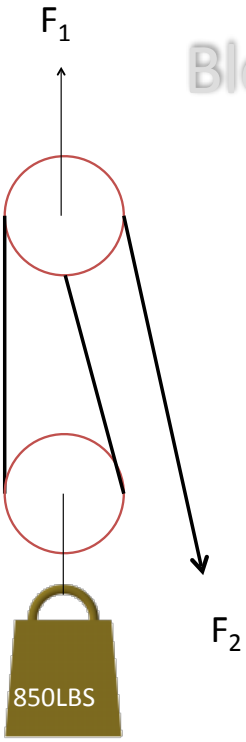
$$F_1 = 1000LBS$$

$$F_2 = \frac{FA}{NumberOfLinesOnRunningBlock}$$

$$F_2 = \frac{500}{1}$$

$$F_2 = 500LBS$$

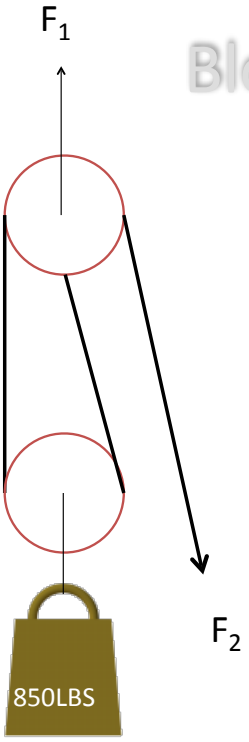
ENTERTAINMENT RIGGING SERVICES, LLC



Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

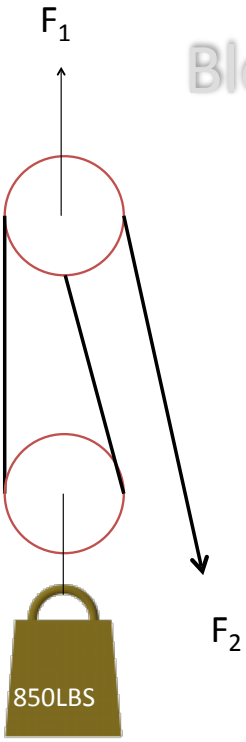
ENTERTAINMENT RIGGING SERVICES, LLC



Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

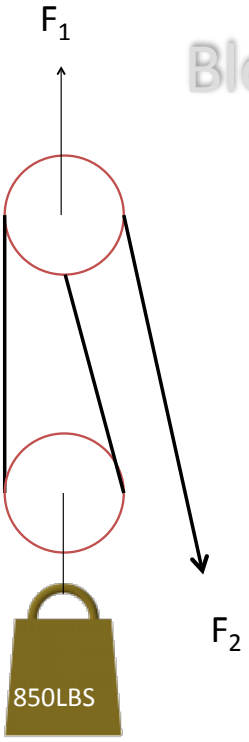
ENTERTAINMENT RIGGING SERVICES, LLC



Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

ENTERTAINMENT RIGGING SERVICES, LLC

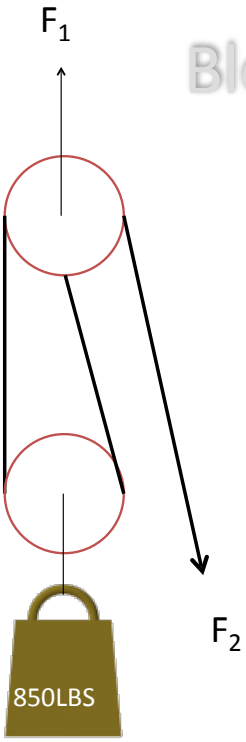


Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{3}{2}(850)$$

ENTERTAINMENT RIGGING SERVICES, LLC



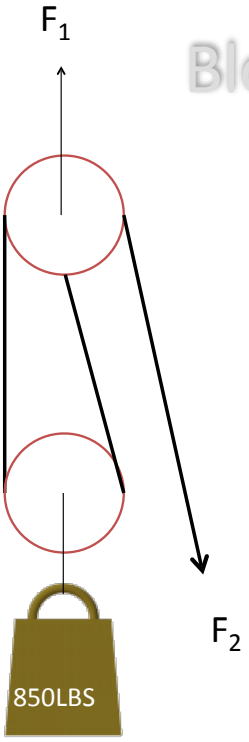
Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{3}{2}(850)$$

$$F_1 = 1275LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC



Block and Fall

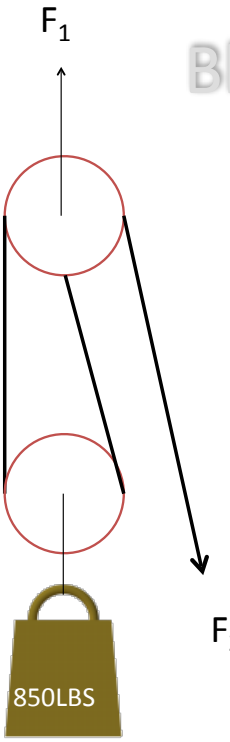
$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{3}{2}(850)$$

$$F_1 = 1275LBS$$

$$F_2 = \frac{FA}{NumberOfLinesOnRunningBlock}$$

ENTERTAINMENT RIGGING SERVICES, LLC



Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

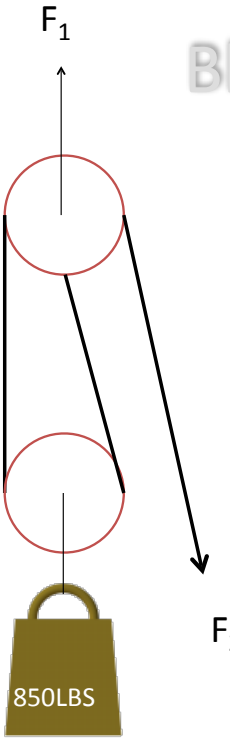
$$F_1 = \frac{3}{2}(850)$$

$$F_1 = 1275LBS$$

$$F_2 = \frac{FA}{NumberOfLinesOnRunningBlock}$$

$$F_2 = \frac{850}{2}$$

ENTERTAINMENT RIGGING SERVICES, LLC



Block and Fall

$$F_1 = \frac{NumberOfLinesOnStandingBlock}{NumberofLinesonRunningBlock}(FA)$$

$$F_1 = \frac{3}{2}(850)$$

$$F_1 = 1275LBS$$

$$F_2 = \frac{FA}{NumberOfLinesOnRunningBlock}$$

$$F_2 = \frac{850}{2}$$

$$F_2 = 425LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Wind Loads

Wind Speed MPH	10	20	30	40	50	60	70	80	90	100	110	120	130
Wind Pressure (Q_S)	.03	1.0	2.3	4.3	6.5	9.3	12.6	16.4	20.8	25.6	31	36.9	43.3

Height in Feet	Exposure Coefficient C_E	
	Average Location	Location Near Large Body of Water
15	1.06	1.39
20	1.13	1.45
25	1.19	1.50
30	1.23	1.54
40	1.31	1.62
60	1.43	1.73

$$P = (1.4)(Q_S)(C_E)(AREA)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Wind Loads

Wind Speed MPH	10	20	30	40	50	60	70	80	90	100	110	120	130
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40	1.31	1.62
60	1.43	1.73

$$P = (1.4)(Q_S)(C_E)(AREA)$$

$$P = (1.4)(4.3)(C_E)(AREA)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Wind Loads

Wind Speed MPH	10	20	30	40	50	60	70	80	90	100	110	120	130
Wind Pressure (Q_S)	.03	1.0	2.3	4.3	6.5	9.3	12.6	16.4	20.8	25.6	31	36.9	43.3

Height in Feet	Exposure Coefficient C_E	
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60	1.43	1.73

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$$P = (1.4)(4.3)(C_E)(AREA)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Wind Loads

Wind Speed MPH	10	20	30	40	50	60	70	80	90	100	110	120	130
Wind Pressure (Q_S)	.03	1.0	2.3	4.3	6.5	9.3	12.6	16.4	20.8	25.6	31	36.9	43.3

Height in Feet	Exposure Coefficient C_E	
	Average Location	Location Near Large Body of Water
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20	1.13	1.45
25	1.19	1.50
30	1.23	1.54
40	1.31	1.62
60	1.43	1.73

$$P = (1.4)(Q_S)(C_E)(AREA)$$

$$P = (1.4)(4.3)(C_E)(AREA)$$

$$P = (1.4)(4.3)(1.9)(AREA)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Wind Loads

Wind Speed MPH	10	20	30	40	50	60	70	80	90	100	110	120	130
Wind Pressure (Q_S)	.03	1.0	2.3	4.3	6.5	9.3	12.6	16.4	20.8	25.6	31	36.9	43.3

Height in Feet	Exposure Coefficient C_E	
	Average Location	Location Near Large Body of Water
15	1.06	1.39
20	1.13	1.45
25	1.19	1.50
30	1.23	1.54
40	1.31	1.62
60	1.43	1.73

$$P = (1.4)(Q_S)(C_E)(AREA)$$
$$P = (1.4)(4.3)(C_E)(AREA)$$
$$P = (1.4)(4.3)(1.9)(AREA)$$
$$P = (1.4)(4.3)(1.9)(300)$$

ENTERTAINMENT RIGGING SERVICES, LLC

Wind Loads

Wind Speed MPH	10	20	30	40	50	60	70	80	90	100	110	120	130
Wind Pressure (Q_S)	.03	1.0	2.3	4.3	6.5	9.3	12.6	16.4	20.8	25.6	31	36.9	43.3

Height in Feet	Exposure Coefficient C_E	
	Average Location	Location Near Large Body of Water
15	1.06	1.39
20	1.13	1.45
25	1.19	1.50
30	1.23	1.54
40	1.31	1.62
60	1.43	1.73

$$P = (1.4)(Q_S)(C_E)(AREA)$$
$$P = (1.4)(4.3)(C_E)(AREA)$$
$$P = (1.4)(4.3)(1.9)(AREA)$$
$$P = (1.4)(4.3)(1.9)(300)$$
$$P = 2150LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

$14 + 16 \div 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

7 x 2 + (7 + 3 x (5-2)) ÷ 4 x 2

7 x 2 + (7 + 3 x 3) ÷ 4 x 2

7 x 2 + (7 + 9) ÷ 4 x 2

7 x 2 + 16 ÷ 4 x 2

14 + 16 ÷ 4 x 2

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

7 x 2 + (7 + 3 x (5-2)) ÷ 4 x 2

7 x 2 + (7 + 3 x 3) ÷ 4 x 2

7 x 2 + (7 + 9) ÷ 4 x 2

7 x 2 + 16 ÷ 4 x 2

14 + 16 ÷ 4 x 2

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

$14 + 16 \div 4 \times 2$

$14 + 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

$14 + 16 \div 4 \times 2$

$14 + 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

$14 + 16 \div 4 \times 2$

$14 + 4 \times 2$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

$7 \times 2 + (7 + 3 \times (5-2)) \div 4 \times 2$

$7 \times 2 + (7 + 3 \times 3) \div 4 \times 2$

$7 \times 2 + (7 + 9) \div 4 \times 2$

$7 \times 2 + 16 \div 4 \times 2$

$14 + 16 \div 4 \times 2$

$14 + 4 \times 2$

$14 + 8$

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

7 x 2 + (7 + 3 x (5-2)) ÷ 4 x 2

7 x 2 + (7 + 3 x 3) ÷ 4 x 2

7 x 2 + (7 + 9) ÷ 4 x 2

7 x 2 + 16 ÷ 4 x 2

14 + 16 ÷ 4 x 2

14 + 4 x 2

14 + 8

ENTERTAINMENT RIGGING SERVICES, LLC

Order of Operation

7 x 2 + (7 + 3 x (5-2)) ÷ 4 x 2

7 x 2 + (7 + 3 x 3) ÷ 4 x 2

7 x 2 + (7 + 9) ÷ 4 x 2

7 x 2 + 16 ÷ 4 x 2

14 + 16 ÷ 4 x 2

14 + 4 x 2

14 + 8

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ENTERTAINMENT RIGGING SERVICES, LLC

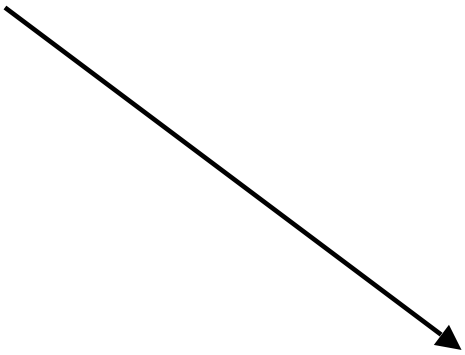
Basic Engineering Principles

Equal Ratios

ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles

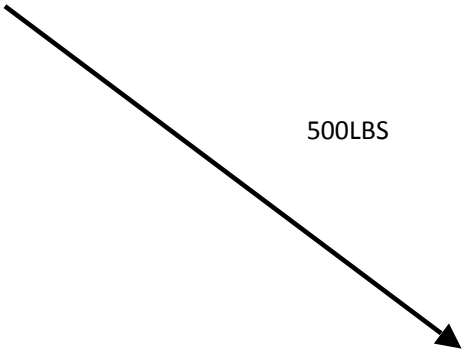
Equal Ratios



ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles

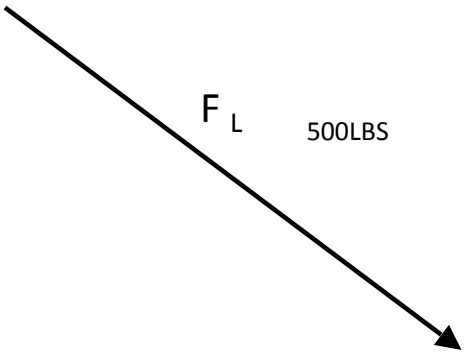
Equal Ratios



ENTERTAINMENT
RIGGING SERVICES, LLC

Basic Engineering Principles

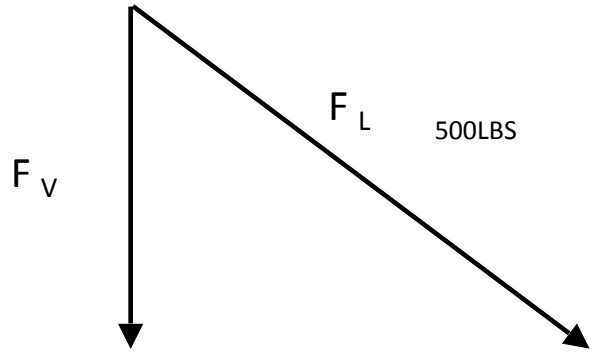
Equal Ratios



ENTERTAINMENT
RIGGING SERVICES, LLC

Basic Engineering Principles

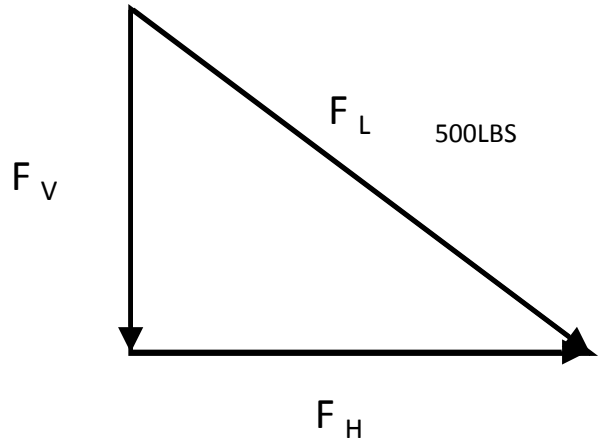
Equal Ratios



ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles

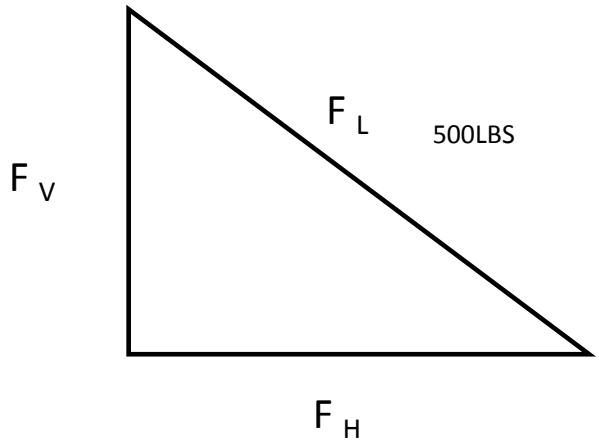
Equal Ratios



ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles

Equal Ratios

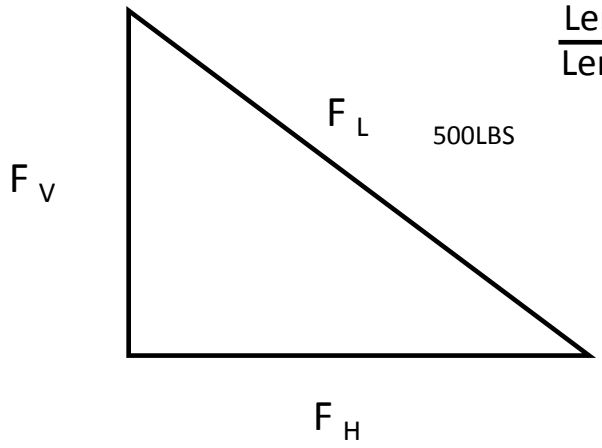


ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles

Equal Ratios

$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

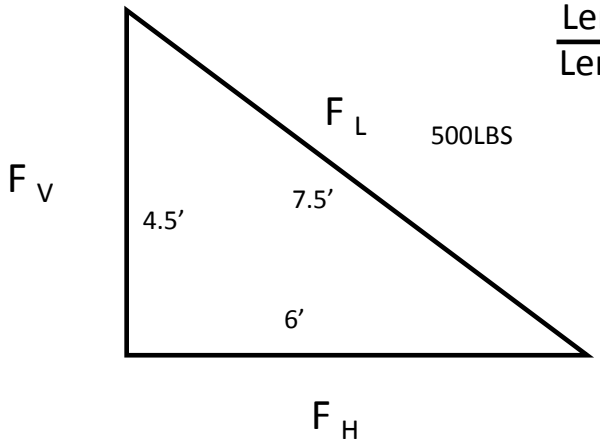


ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles

Equal Ratios

$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

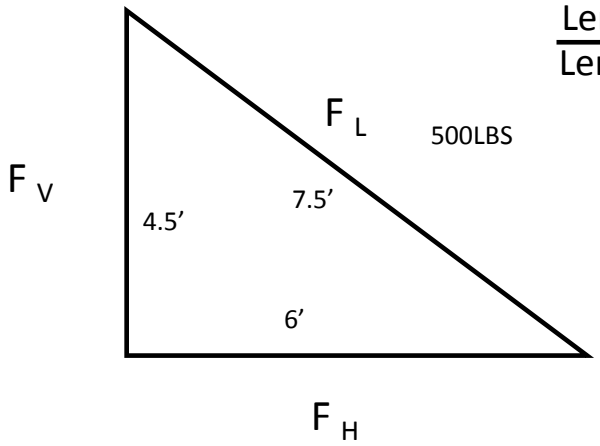


Basic Engineering Principles

Equal Ratios

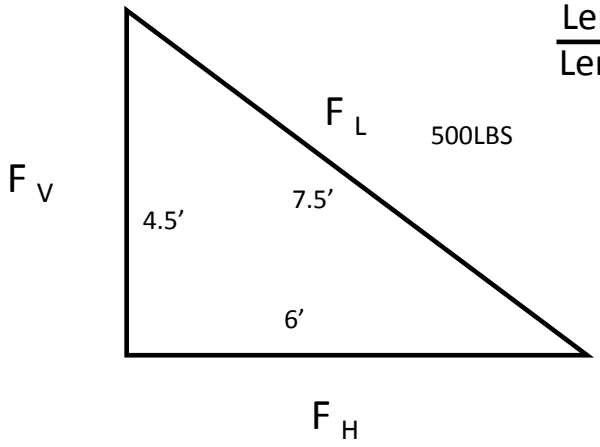
$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

$$\frac{7.5}{6} = \frac{500}{F_H}$$



Basic Engineering Principles

Equal Ratios



$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

$$7.5\,(F_H) = 500\,(6)$$

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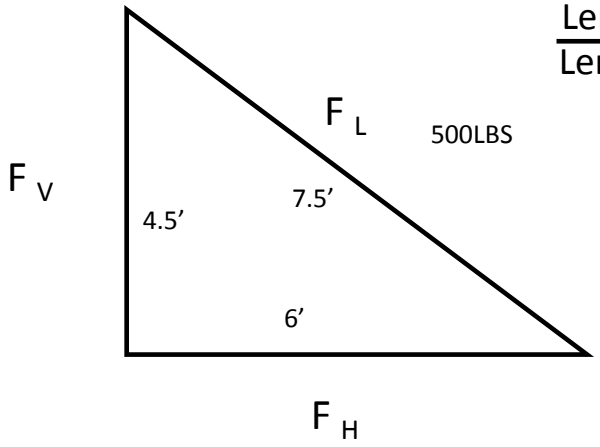
Basic Engineering Principles

Equal Ratios



$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

$$7.5\,(F_H) = 500\,(6)$$

$$(7.5)(F_H) = 3000$$

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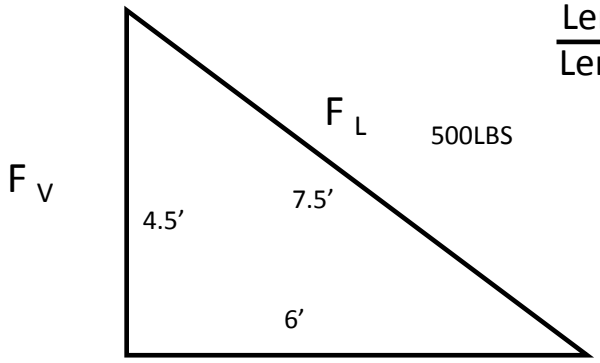
Basic Engineering Principles

Equal Ratios



$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

$$7.5\,(F_H) = 500\,(6)$$

$$\frac{(7.5)(F_H)}{7.5} = \frac{3000}{7.5}$$

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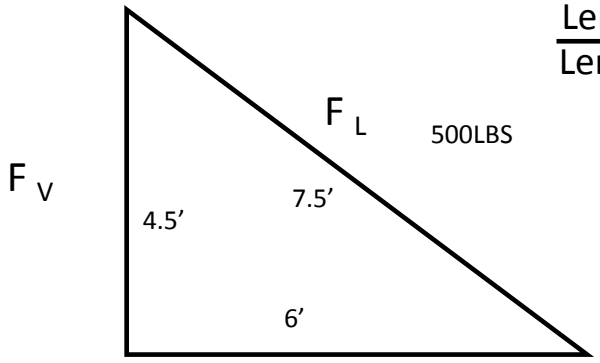
Basic Engineering Principles

Equal Ratios



$$\frac{\text{Length L}}{\text{Length H}} = \frac{\text{Force L}}{\text{Force H}}$$

$$7.5\,(F_H) = 500\,(6)$$

$$\frac{(7.5)(F_H)}{7.5} = \frac{3000}{7.5}$$

$$F_H = 400\text{LBS}$$

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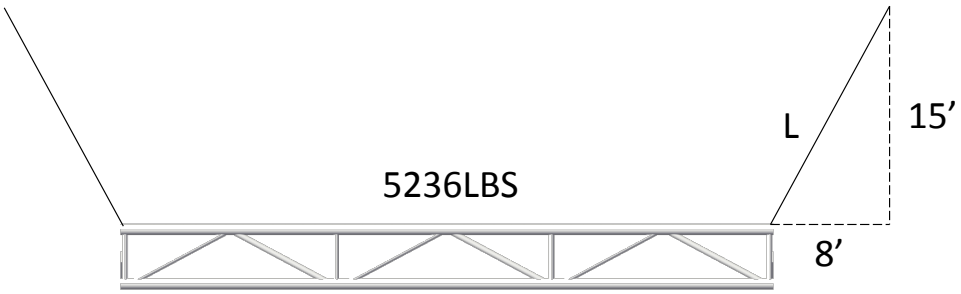
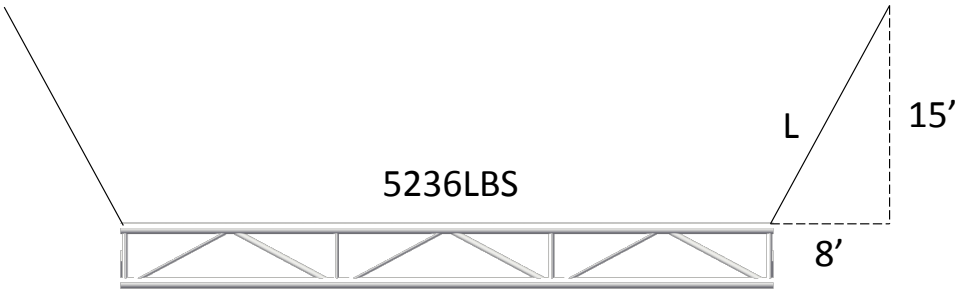
Basic Engineering Principles



What is the Length of L?
What is the Force on L?

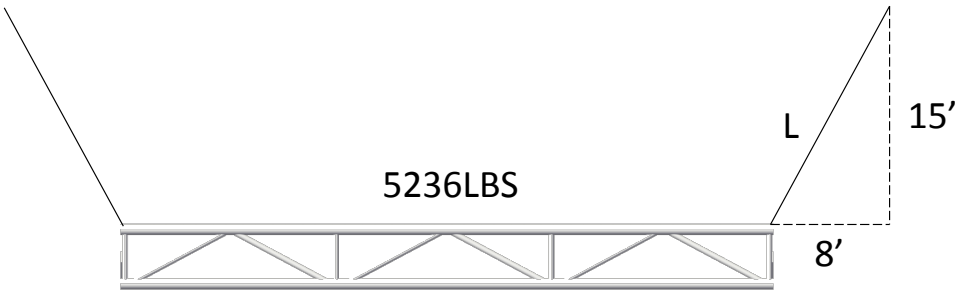
ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles



ENTERTAINMENT RIGGING SERVICES, LLC

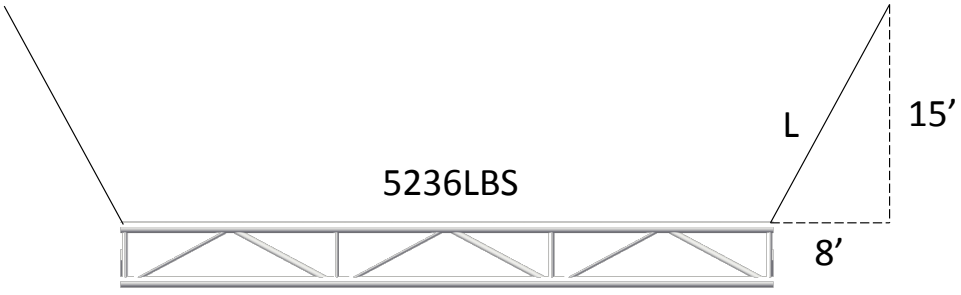
Basic Engineering Principles



$$L = \sqrt{V^2 + H^2}$$

ENTERTAINMENT RIGGING SERVICES, LLC

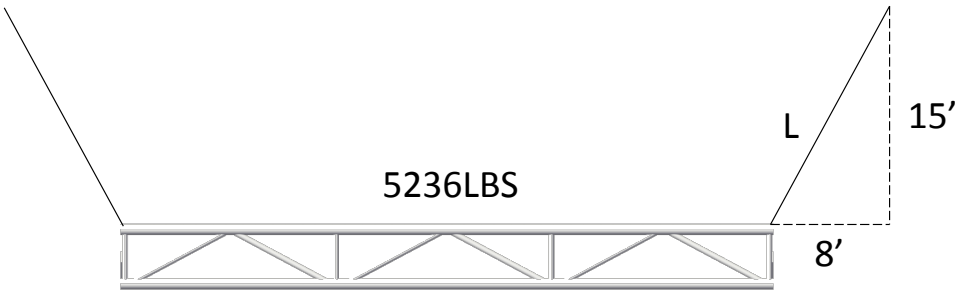
Basic Engineering Principles



$$L = \sqrt{V^2 + H^2} = \sqrt{15^2 + 8^2}$$

ENTERTAINMENT RIGGING SERVICES, LLC

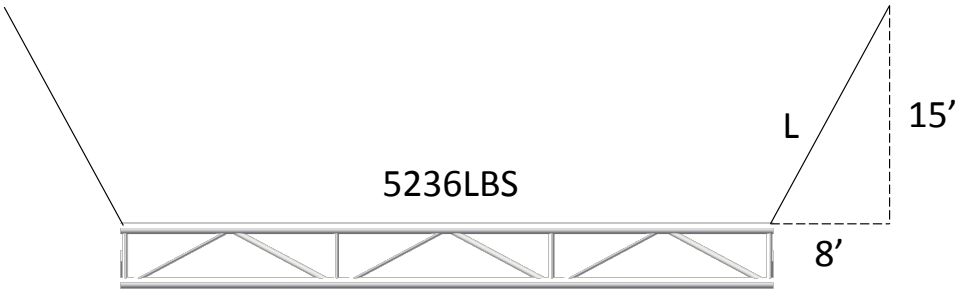
Basic Engineering Principles



$$L = \sqrt{V^2 + H^2} = \sqrt{15^2 + 8^2} = \sqrt{225 + 64}$$

ENTERTAINMENT RIGGING SERVICES, LLC

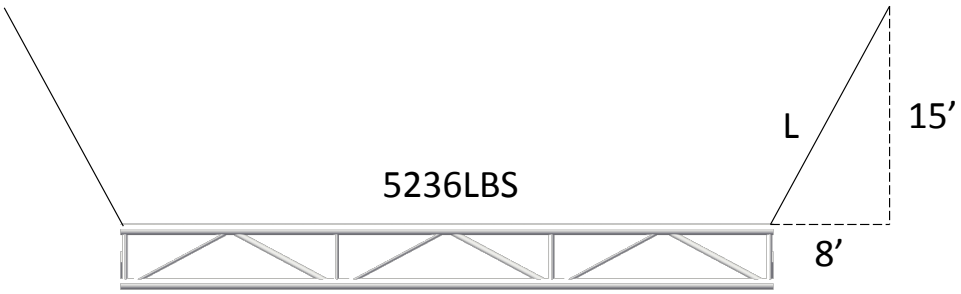
Basic Engineering Principles



$$L = \sqrt{V^2 + H^2} = \sqrt{15^2 + 8^2} = \sqrt{225 + 64} = \sqrt{289}$$

ENTERTAINMENT RIGGING SERVICES, LLC

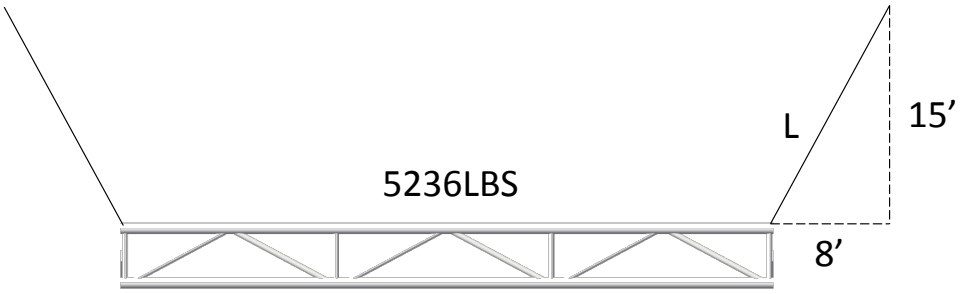
Basic Engineering Principles



$$L = \sqrt{V^2 + H^2} = \sqrt{15^2 + 8^2} = \sqrt{225 + 64} = \sqrt{289} = 17$$

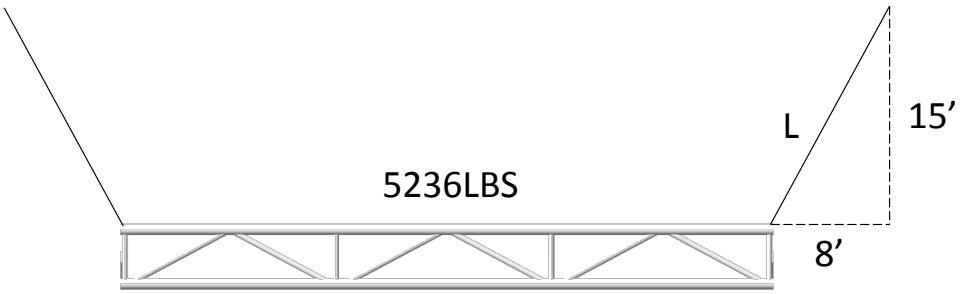
ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles



ENTERTAINMENT RIGGING SERVICES, LLC

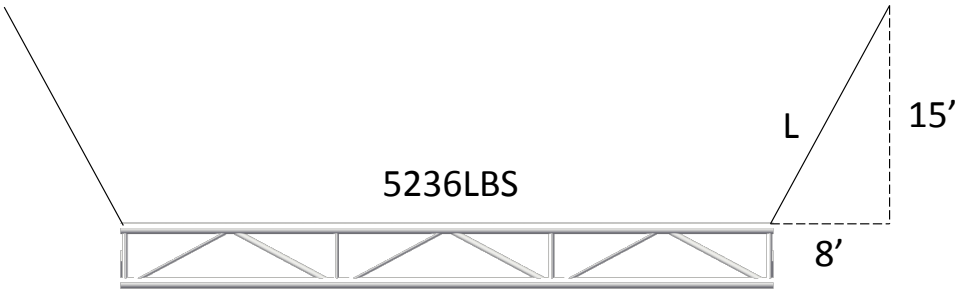
Basic Engineering Principles



$$\text{Force L} = \frac{\text{Length L}}{\text{Length V}} \text{ (Force V)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Basic Engineering Principles



$$\text{Force L} = \frac{\text{Length L}}{\text{Length V}} \text{ (Force V)} = \frac{17}{15} \text{ (2618)}$$

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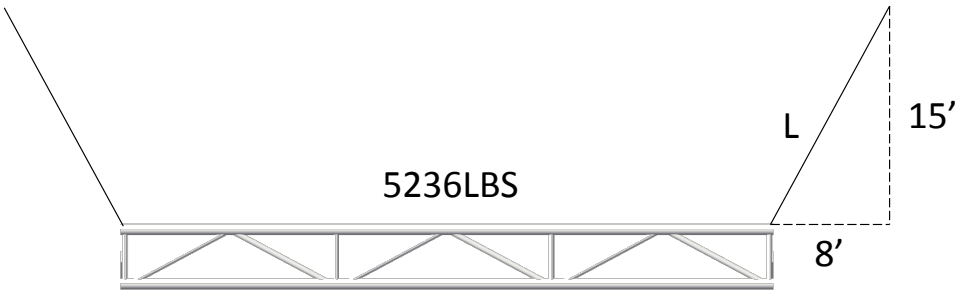
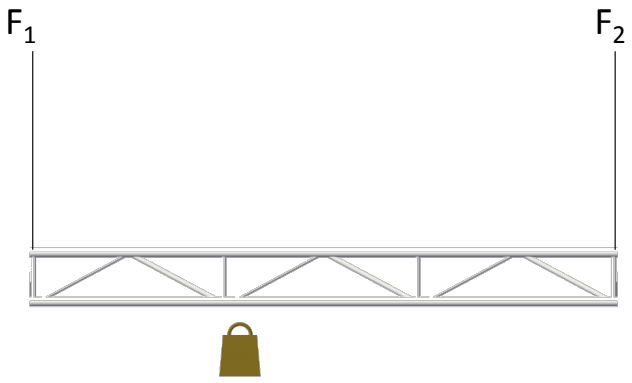
Basic Engineering Principles



$$\text{Force L} = \frac{\text{Length L}}{\text{Length V}}\text{(Force V)} = \frac{17}{15}(2618) = 2968$$

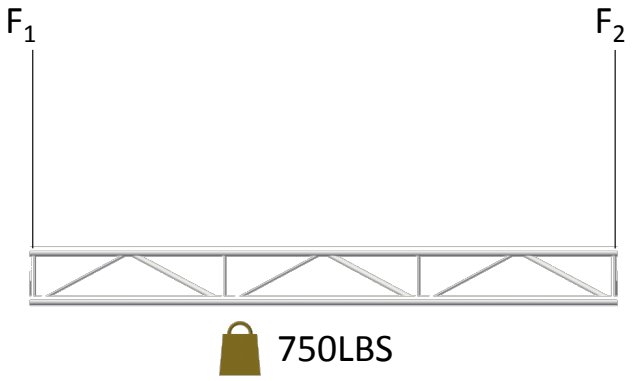
ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



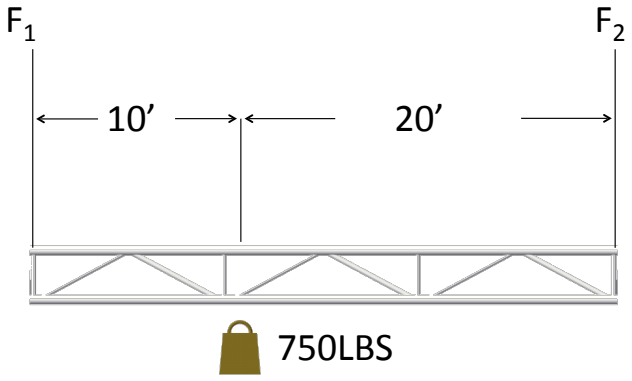
ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



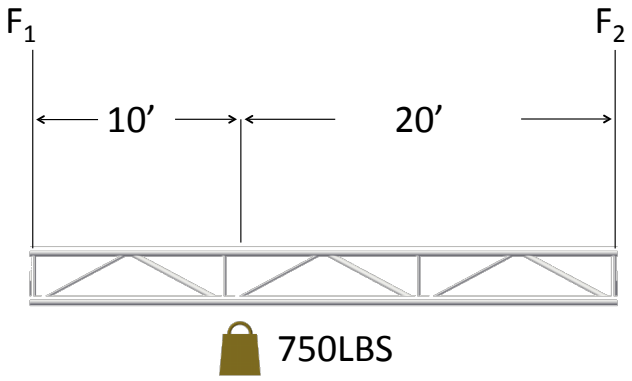
ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



ENTERTAINMENT RIGGING SERVICES, LLC

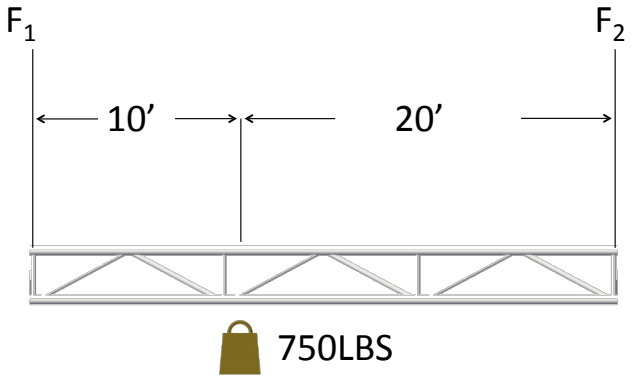
Simple Span



$$F_1 = (FA)\frac{D_2}{S}$$

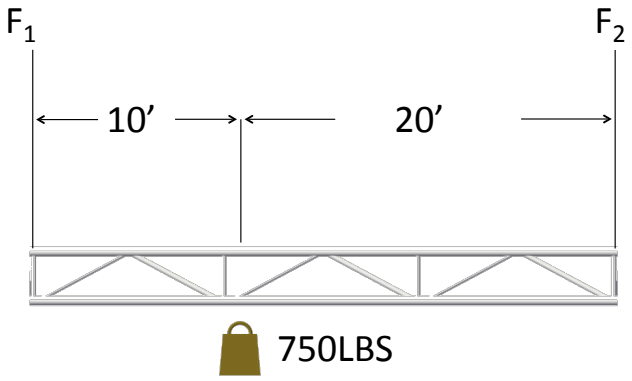
ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



ENTERTAINMENT RIGGING SERVICES, LLC

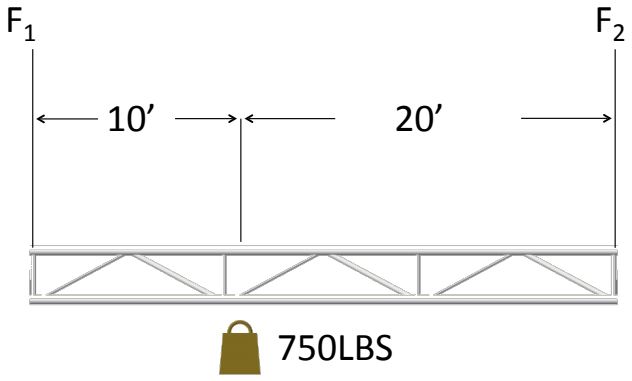
Simple Span



$$F_1 = (750)\frac{20}{30}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span

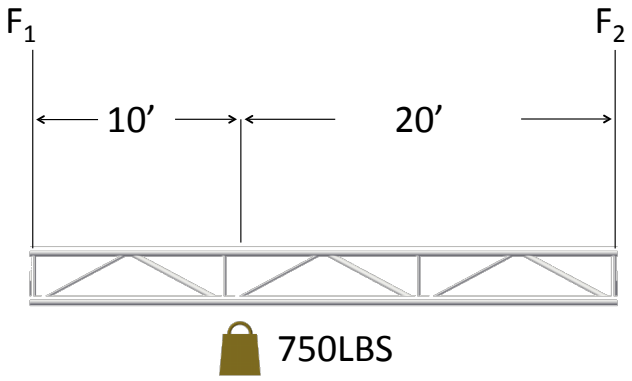


$$F_1 = (750)\frac{20}{30}$$

$$F_1 = 500LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



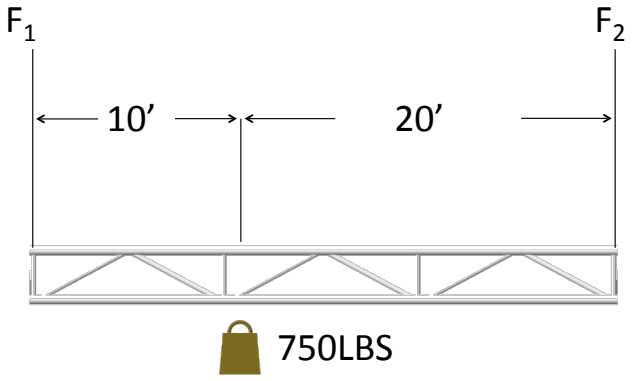
$$F_1 = (750)\frac{20}{30}$$

$$F_1 = 500LBS$$

$$F_2 = \frac{(FA)(D_1)}{S}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span

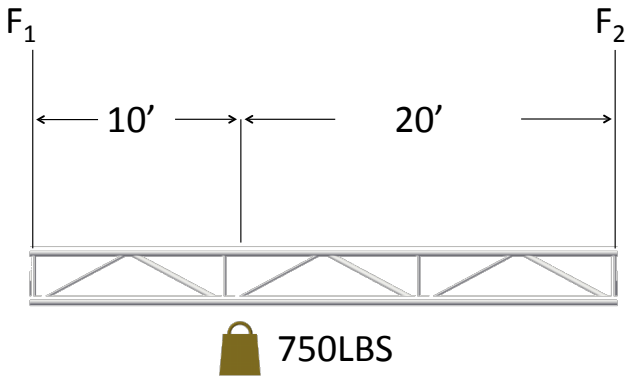


$$F_1 = (750)\frac{20}{30}$$

$$F_1 = 500LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



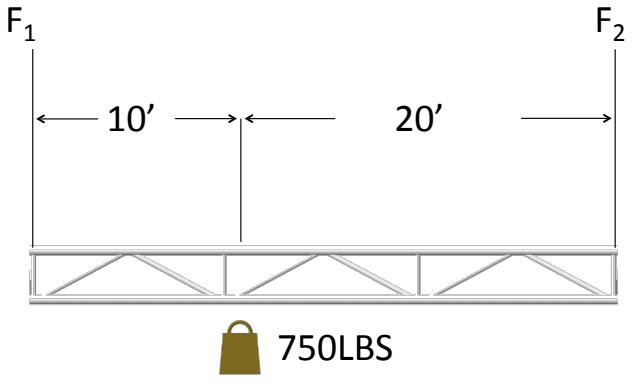
$$F_1 = (750)\frac{20}{30}$$

$$F_1 = 500LBS$$

$$F_2 = \frac{(750)(10)}{30}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Simple Span



$$F_1 = (750)\frac{20}{30}$$

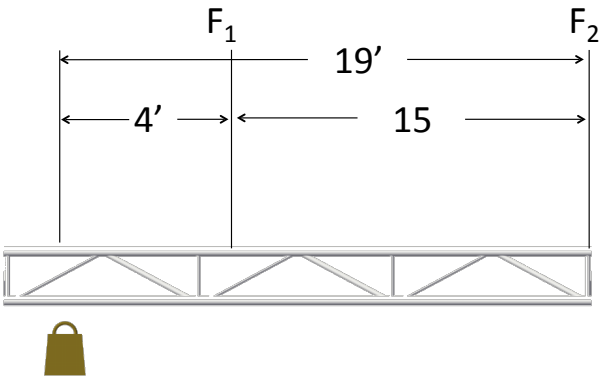
$$F_1 = 500LBS$$

$$F_2 = \frac{(750)(10)}{30}$$

$$F_2 = 250LBS$$

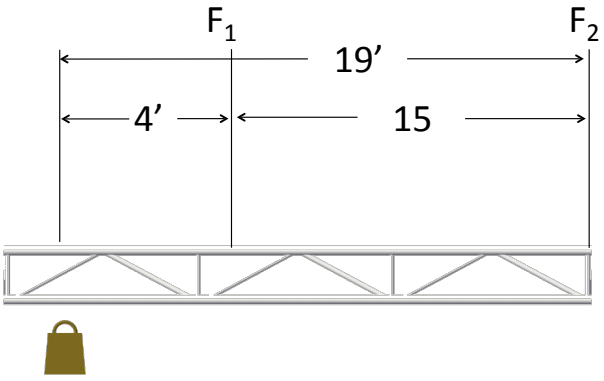
ENTERTAINMENT RIGGING SERVICES, LLC

Cantilevers



ENTERTAINMENT RIGGING SERVICES, LLC

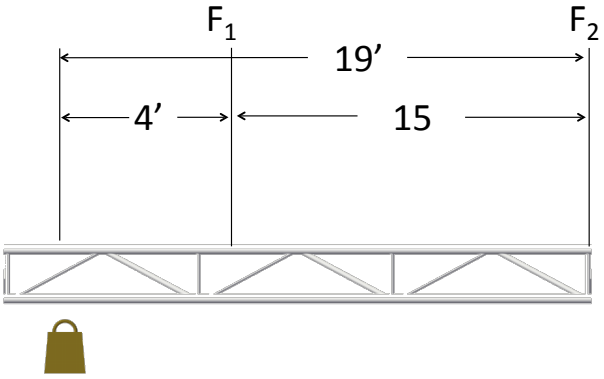
Cantilevers



$$F_1 = \frac{(FA)(D_2)}{S}$$

ENTERTAINMENT RIGGING SERVICES, LLC

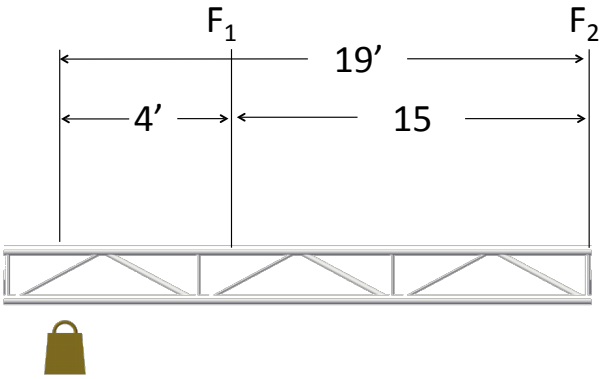
Cantilevers



$$F_1 = \frac{(600)(19)}{15}$$

ENTERTAINMENT RIGGING SERVICES, LLC

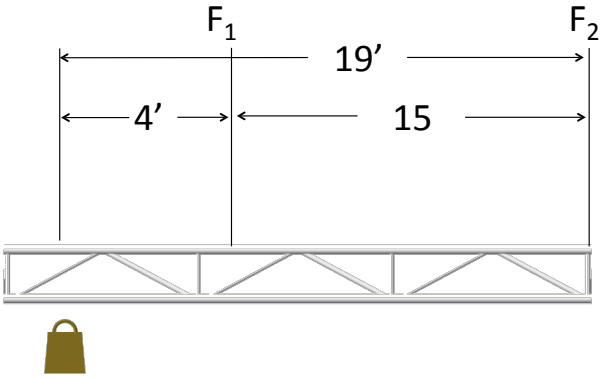
Cantilevers



$$F_1 = 760LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

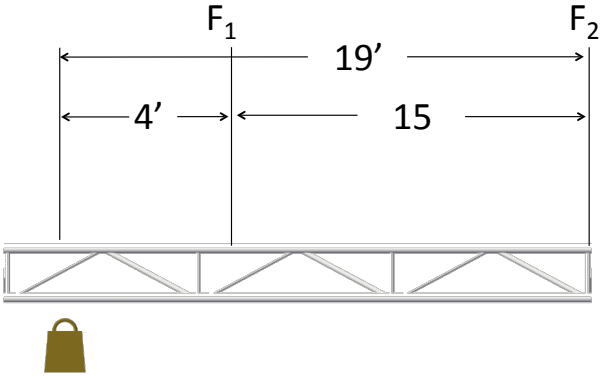
Cantilevers



$$F_1 = 760LBS \qquad F_2 = \frac{-(FA)(D_1)}{S}$$

ENTERTAINMENT RIGGING SERVICES, LLC

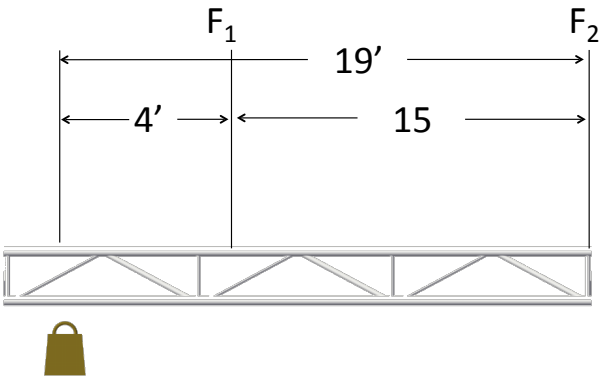
Cantilevers



$$F_1 = 760LBS \qquad F_2 = \frac{-(600)(4)}{15}$$

ENTERTAINMENT RIGGING SERVICES, LLC

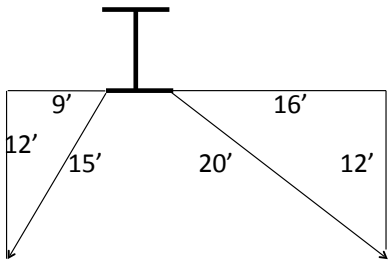
Cantilevers



$$F_1 = 760LBS \qquad F_2 = -160LBS$$

Resultant Loads

Using Resultants to figure out loads on beams

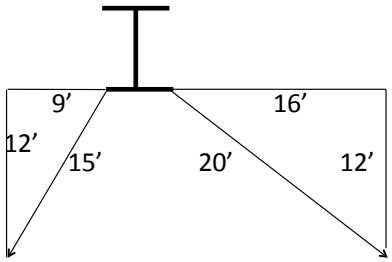


1500LBS 1200LBS

Resultant Loads

Using Resultants to figure out loads on beams

1. Figure out Horizontal Forces
2. Figure Out Vertical Forces
3. Add (or Subtract) Horizontal forces
4. Add (or Subtract) Vertical forces
5. Using the Pythagorean Theorem, Find the Resultant Load

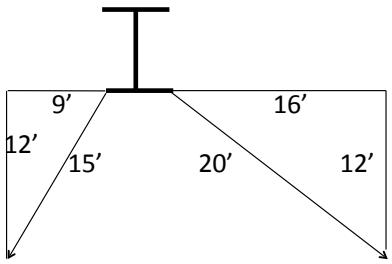


1500LBS 1200LBS

ENTERTAINMENT RIGGING SERVICES, LLC

Resultant Loads

Using Resultants to figure out loads on beams



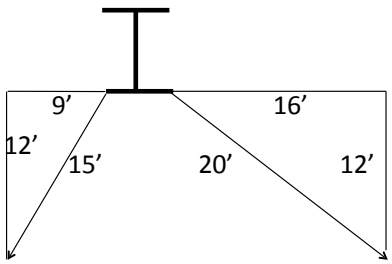
1500LBS 1200LBS

ENTERTAINMENT RIGGING SERVICES, LLC

Resultant Loads

Using Resultants to figure out loads on beams

$$F_H = (\frac{D_H}{D_L})(FA)$$



1500LBS 1200LBS

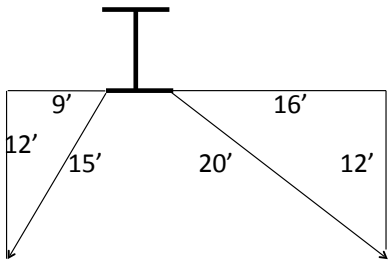
ENTERTAINMENT RIGGING SERVICES, LLC

Resultant Loads

Using Resultants to figure out loads on beams

$$F_H = (\frac{D_H}{D_L})(FA)$$

$$F_H = (\frac{16}{20})(1200)$$

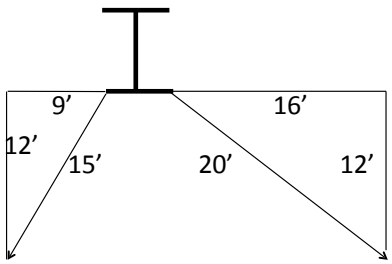


1500LBS 1200LBS

ENTERTAINMENT RIGGING SERVICES, LLC

Resultant Loads

Using Resultants to figure out loads on beams



1500LBS 1200LBS

$$F_H = (\frac{D_H}{D_L})(FA)$$

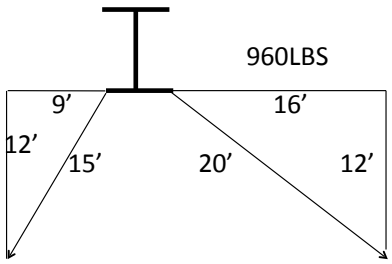
$$F_H = (\frac{16}{20})(1200)$$

$$F_H = 960$$

ENTERTAINMENT RIGGING SERVICES, LLC

Resultant Loads

Using Resultants to figure out loads on beams



1500LBS 1200LBS

$$F_H = (\frac{D_H}{D_L})(FA)$$

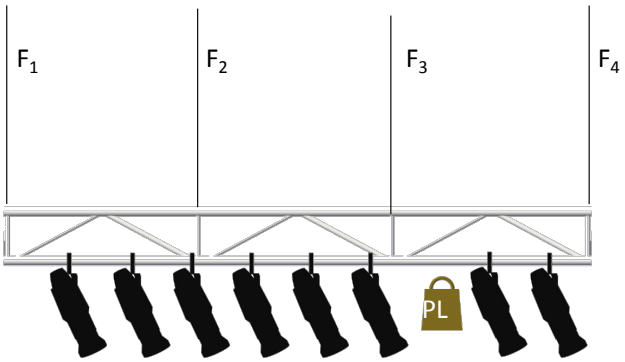
$$F_H = (\frac{16}{20})(1200)$$

$$F_H = 960$$

ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

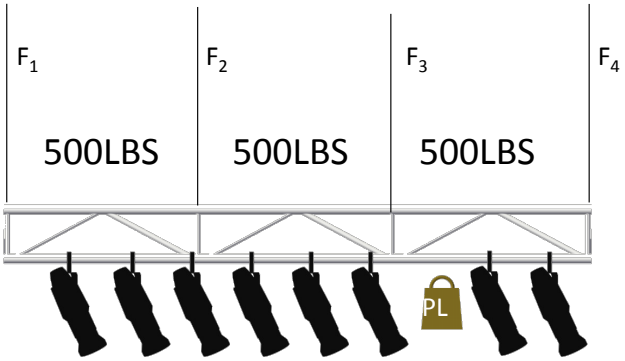
.5 Span Span + 14% Span + 14% .5 Span



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

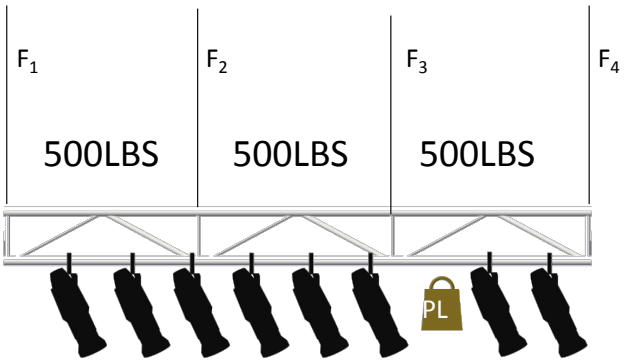
.5 Span Span + 14% Span + 14% .5 Span



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

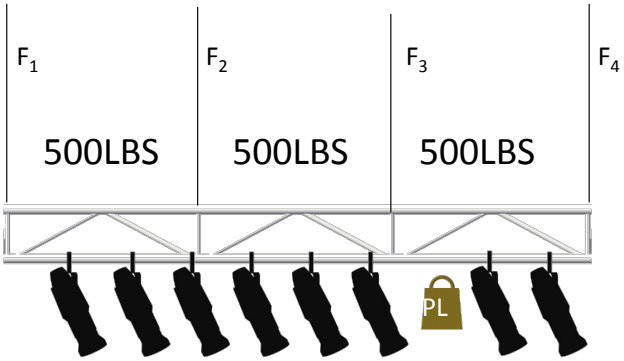
Span + 14% Span + 14%



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

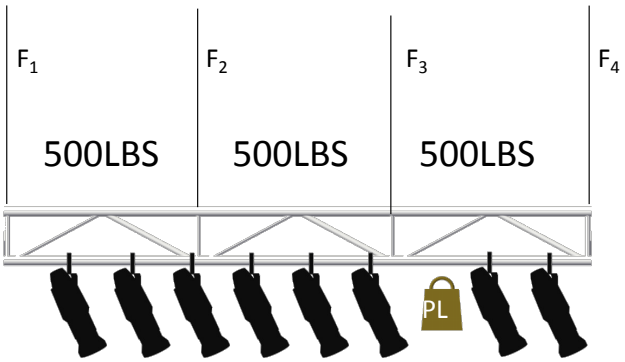
250LBS Span + 14% Span + 14% 250LBS



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

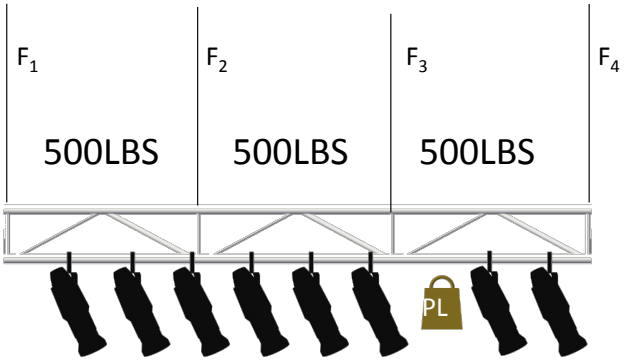
250LBS 250LBS



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

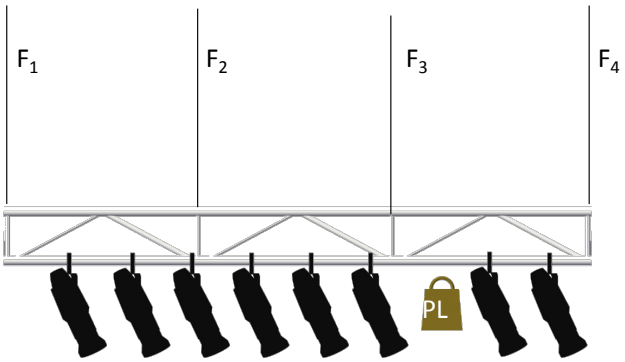
250LBS 570LBS 570LBS 250LBS



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

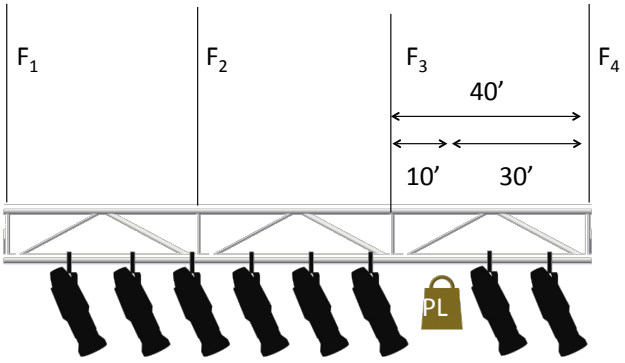
250LBS 570LBS 570LBS 250LBS



ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

250LBS 570LBS 570LBS 250LBS

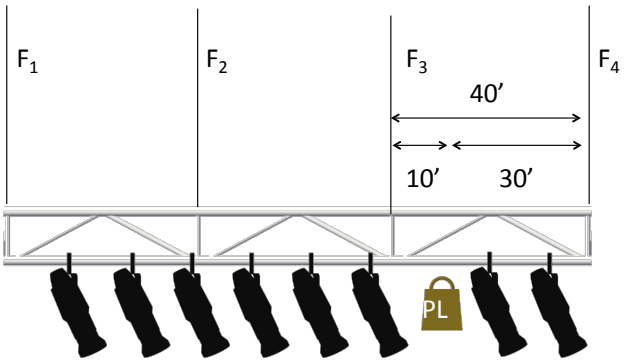


250LBS

ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

250LBS 570LBS 570LBS 250LBS



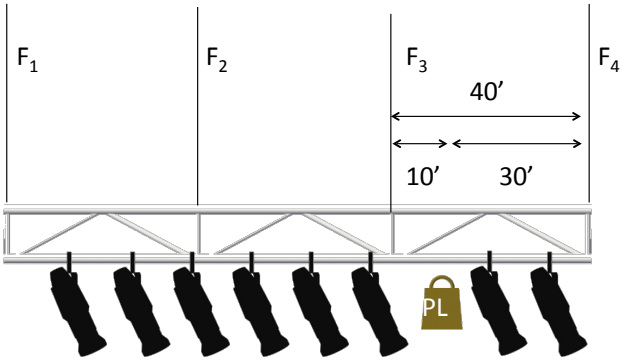
250LBS

$$F_3 = \frac{(FA)(D_4)}{S}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

250LBS 570LBS 570LBS 250LBS



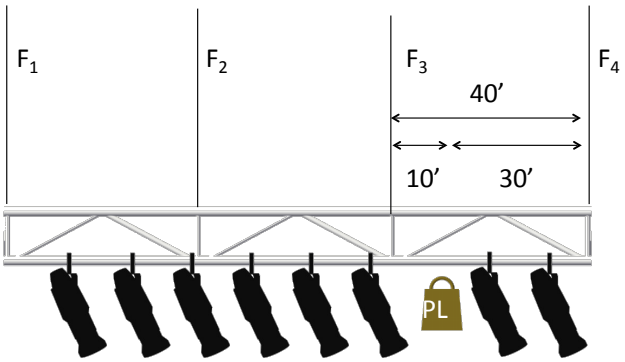
250LBS

$$F_3 = \frac{(FA)(D_4)}{S} \qquad F_3 = \frac{(250)(30)}{40}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Complex Structures

250LBS 570LBS 570LBS 250LBS

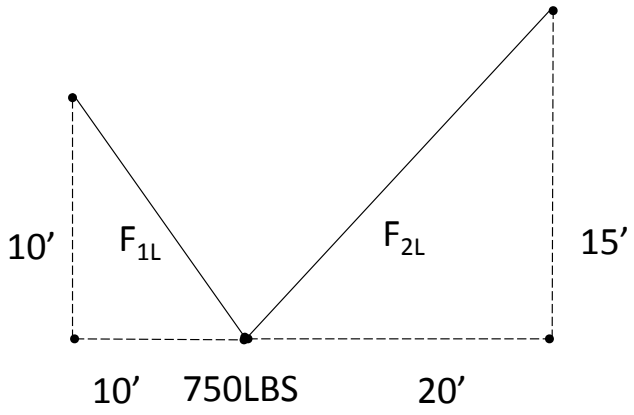


250LBS

$$F_3 = \frac{(FA)(D_4)}{S} \qquad F_3 = \frac{(250)(30)}{40} \qquad F_3 = 187.5LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

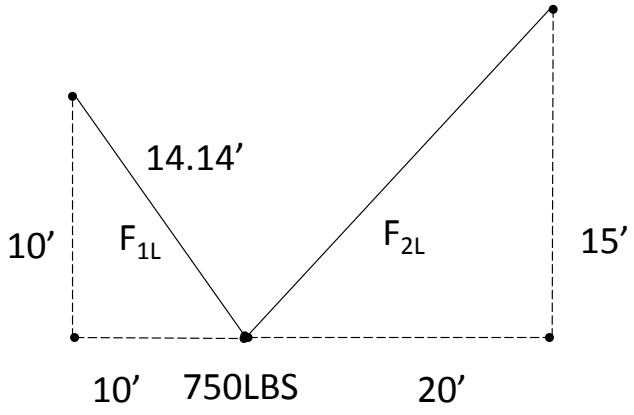
Math Solutions to Simple Bridles



$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

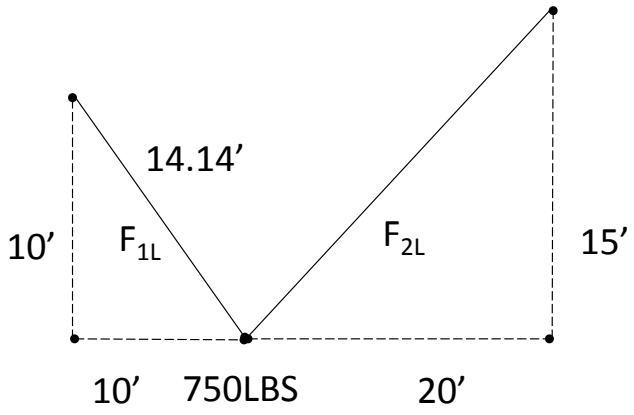
Math Solutions to Simple Bridles



$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

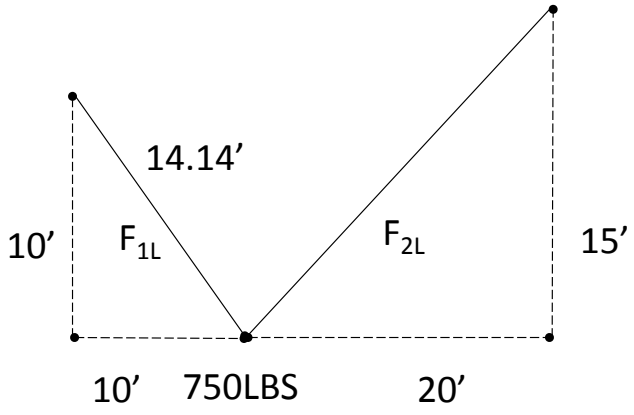


$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{1L} = \frac{(750)(20)(14.14)}{(10)(20) + (15)(10)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



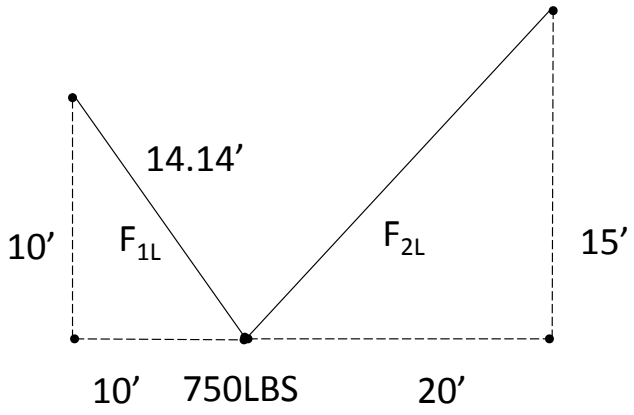
$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{1L} = \frac{(750)(20)(14.14)}{(10)(20) + (15)(10)}$$

$$F_{1L} = \frac{212100}{350}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

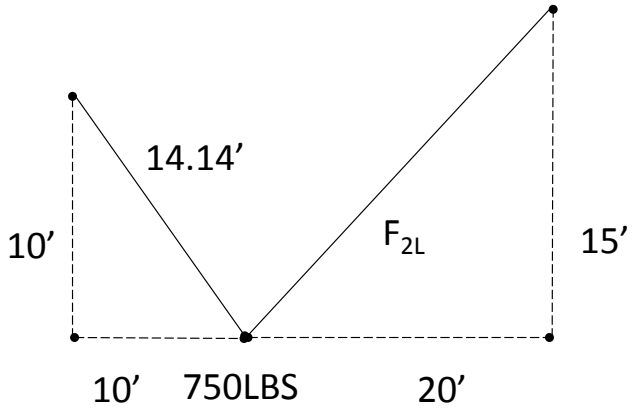
$$F_{1L} = \frac{(750)(20)(14.14)}{(10)(20) + (15)(10)}$$

$$F_{1L} = \frac{212100}{350}$$

$$F_{1L} = 607LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

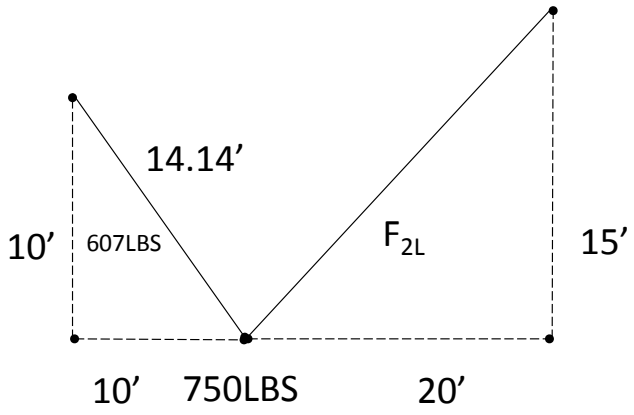
$$F_{1L} = \frac{(750)(20)(14.14)}{(10)(20) + (15)(10)}$$

$$F_{1L} = \frac{212100}{350}$$

$$F_{1L} = 607LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1L} = \frac{(FA)D_{2H}D_{1L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

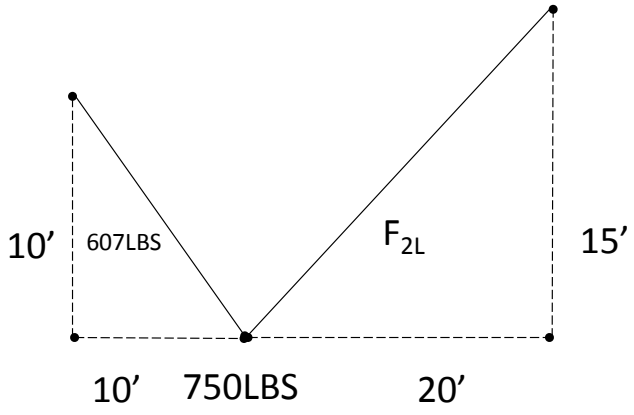
$$F_{1L} = \frac{(750)(20)(14.14)}{(10)(20) + (15)(10)}$$

$$F_{1L} = \frac{212100}{350}$$

$$F_{1L} = 607LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

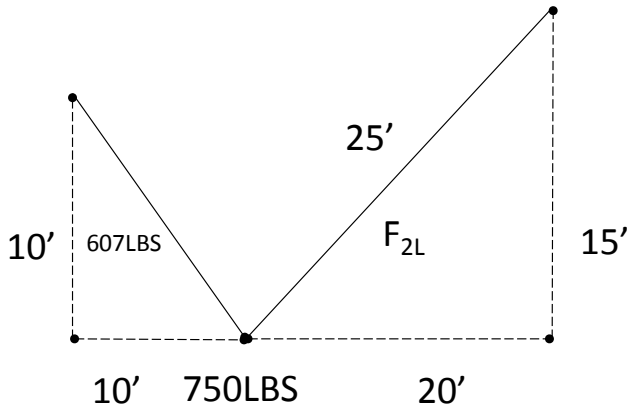
Math Solutions to Simple Bridles



$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

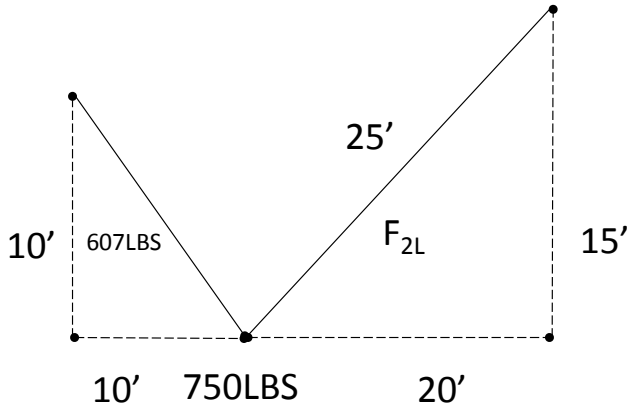
Math Solutions to Simple Bridles



$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

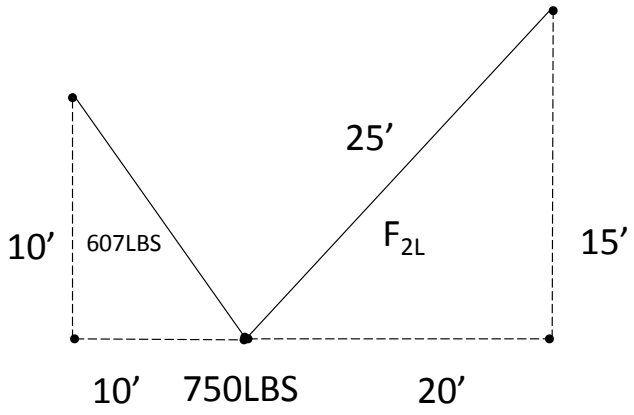


$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{2L} = \frac{(750)(10)(25)}{(10)(20) + (15)(10)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



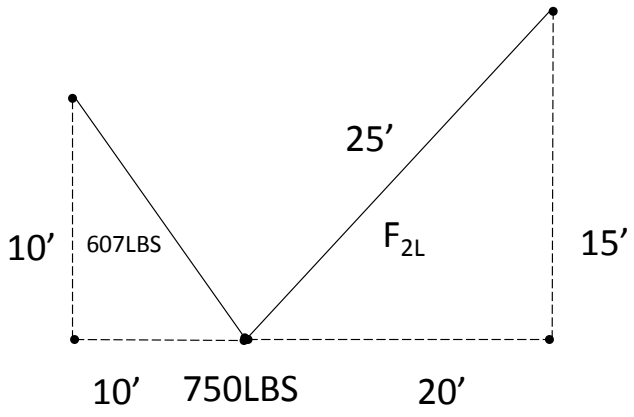
$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{2L} = \frac{(750)(10)(25)}{(10)(20) + (15)(10)}$$

$$F_{2L} = \frac{187500}{350}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

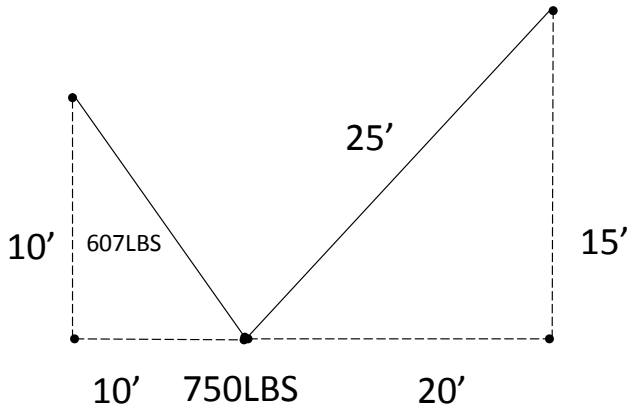
$$F_{2L} = \frac{(750)(10)(25)}{(10)(20) + (15)(10)}$$

$$F_{2L} = \frac{187500}{350}$$

$$F_{2L} = 536LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

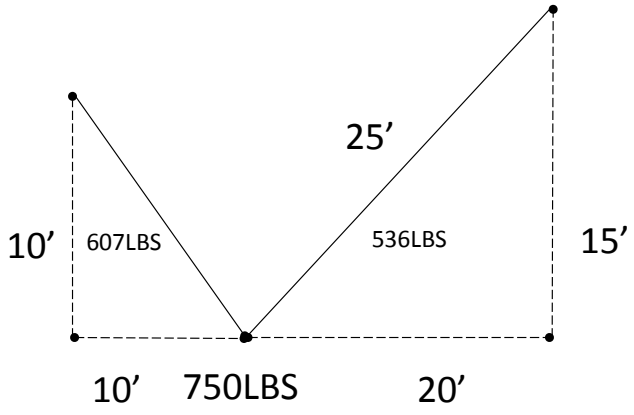
$$F_{2L} = \frac{(750)(10)(25)}{(10)(20) + (15)(10)}$$

$$F_{2L} = \frac{187500}{350}$$

$$F_{2L} = 536LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{2L} = \frac{(FA)D_{1H}D_{2L}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

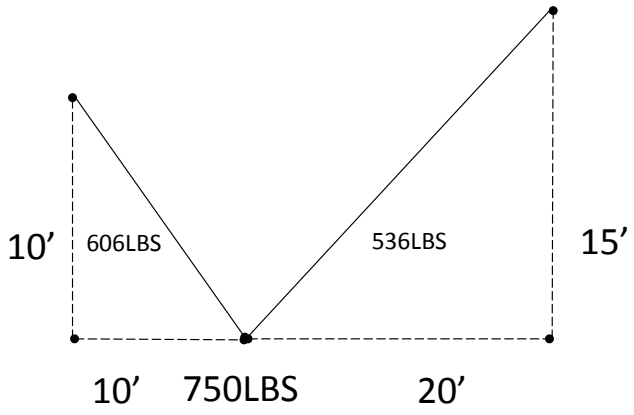
$$F_{2L} = \frac{(750)(10)(25)}{(10)(20) + (15)(10)}$$

$$F_{2L} = \frac{187500}{350}$$

$$F_{2L} = 536LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

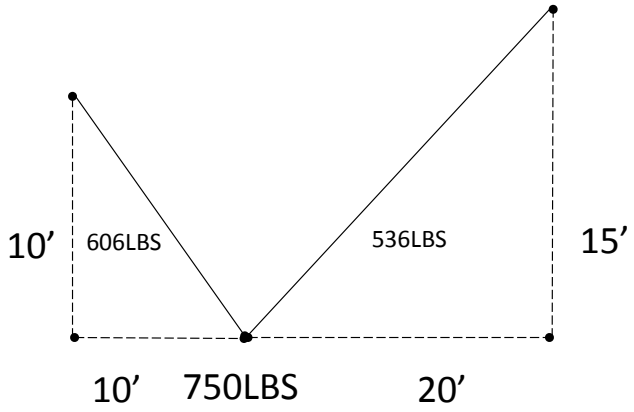
Math Solutions to Simple Bridles



$$F_{1V} = \frac{(FA)D_{2H}D_{1V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

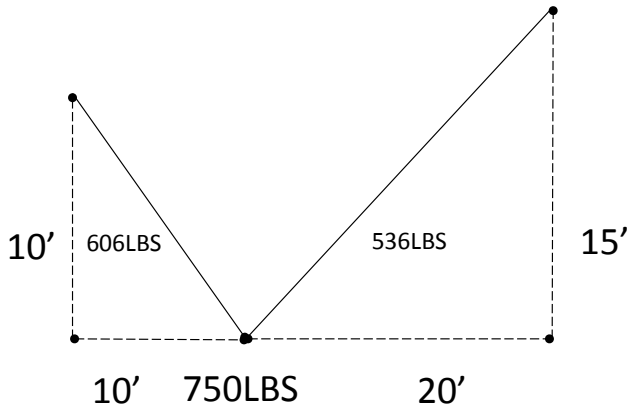


$$F_{1V} = \frac{(FA)D_{2H}D_{1V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{1V} = \frac{(750)(20)(10)}{(10)(20) + (15)(10)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



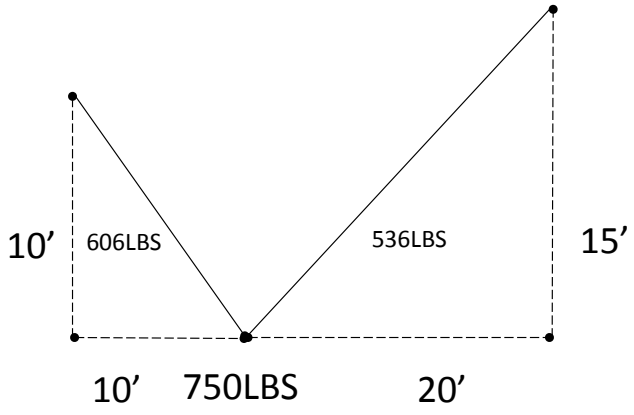
$$F_{1V} = \frac{(FA)D_{2H}D_{1V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{1V} = \frac{(750)(20)(10)}{(10)(20) + (15)(10)}$$

$$F_{1V} = \frac{150000}{350}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1V} = \frac{(FA)D_{2H}D_{1V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

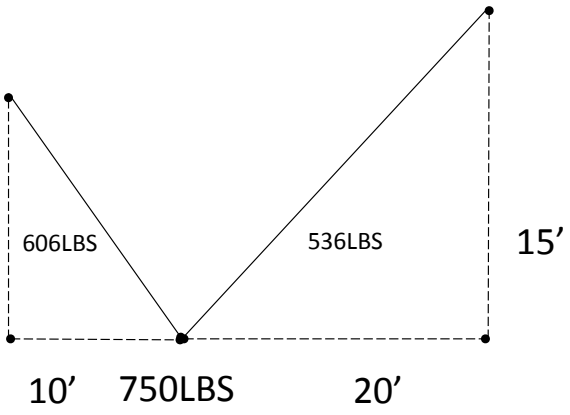
$$F_{1V} = \frac{(750)(20)(10)}{(10)(20) + (15)(10)}$$

$$F_{1V} = \frac{150000}{350}$$

$$F_{1V} = 429LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1V} = \frac{(FA)D_{2H}D_{1V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

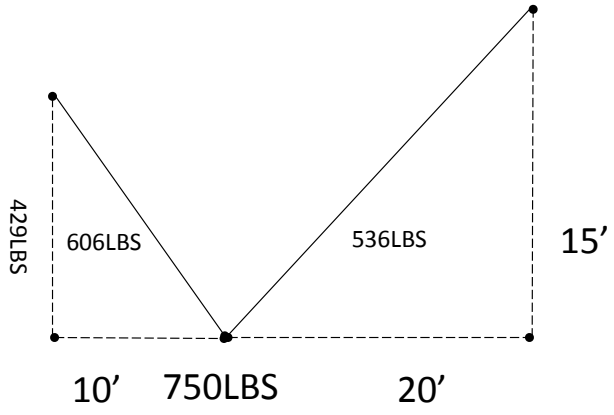
$$F_{1V} = \frac{(750)(20)(10)}{(10)(20) + (15)(10)}$$

$$F_{1V} = \frac{150000}{350}$$

$$F_{1V} = 429LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1V} = \frac{(FA)D_{2H}D_{1V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

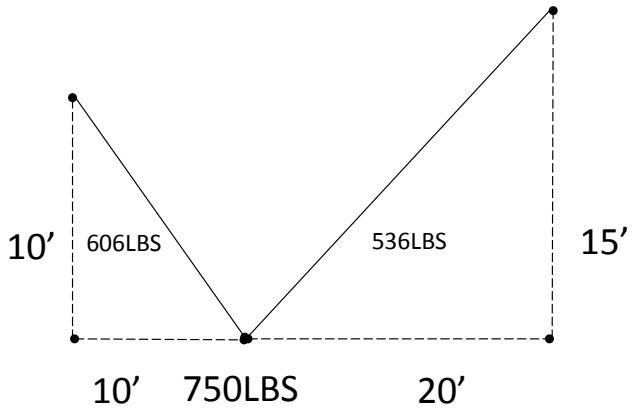
$$F_{1V} = \frac{(750)(20)(10)}{(10)(20) + (15)(10)}$$

$$F_{1V} = \frac{150000}{350}$$

$$F_{1V} = 429LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

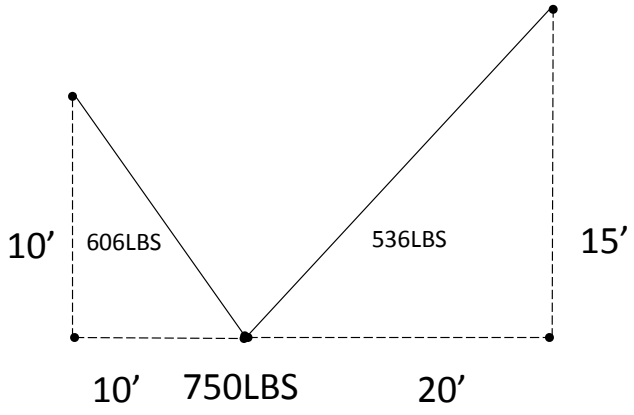
Math Solutions to Simple Bridles



$$F_{2V} = \frac{(FA)D_{1H}D_{2V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

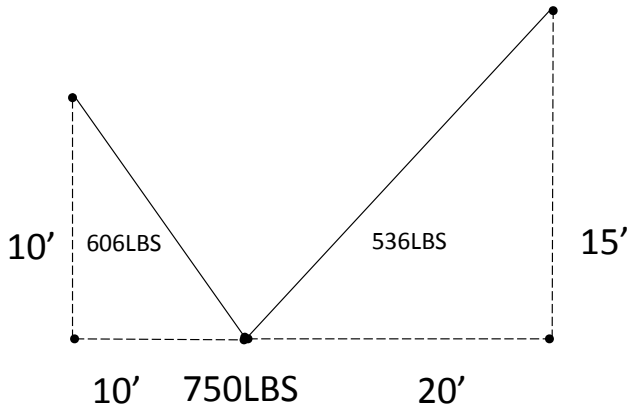


$$F_{2V} = \frac{(FA)D_{1H}D_{2V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{2V} = \frac{(750)(10)(15)}{(10)(20) + (15)(10)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



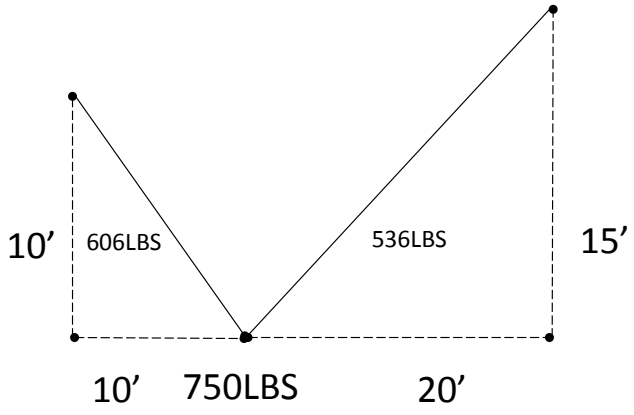
$$F_{2V} = \frac{(FA)D_{1H}D_{2V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_{2V} = \frac{(750)(10)(15)}{(10)(20) + (15)(10)}$$

$$F_{2V} = \frac{112500}{350}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{2V} = \frac{(FA)D_{1H}D_{2V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

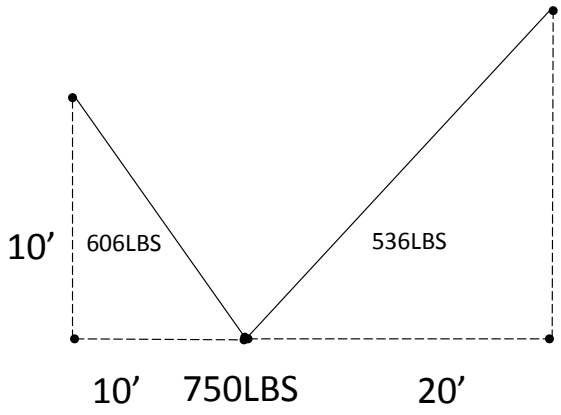
$$F_{2V} = \frac{(750)(10)(15)}{(10)(20) + (15)(10)}$$

$$F_{2V} = \frac{112500}{350}$$

$$F_{2V} = 322LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{2V} = \frac{(FA)D_{1H}D_{2V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

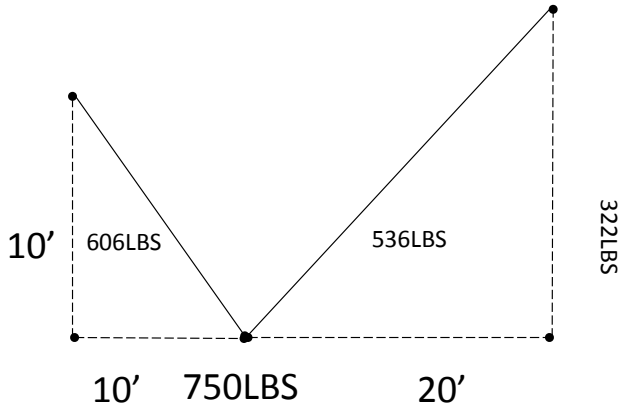
$$F_{2V} = \frac{(750)(10)(15)}{(10)(20) + (15)(10)}$$

$$F_{2V} = \frac{112500}{350}$$

$$F_{2V} = 322LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{2V} = \frac{(FA)D_{1H}D_{2V}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

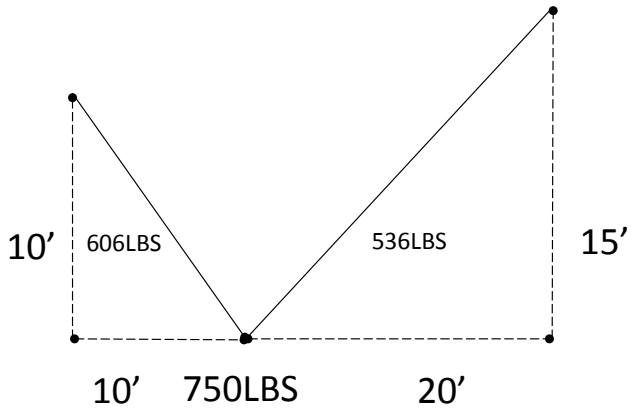
$$F_{2V} = \frac{(750)(10)(15)}{(10)(20) + (15)(10)}$$

$$F_{2V} = \frac{112500}{350}$$

$$F_{2V} = 322LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

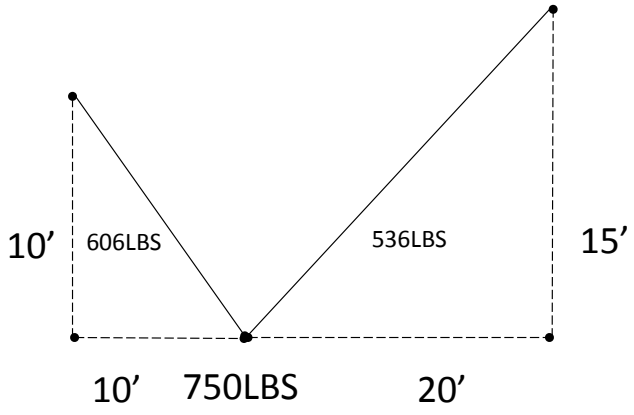
Math Solutions to Simple Bridles



$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

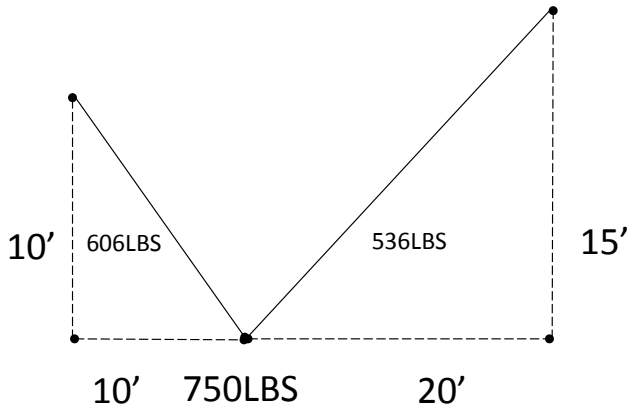


$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_H = \frac{(750)(10)(20)}{(10)(20) + (15)(10)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



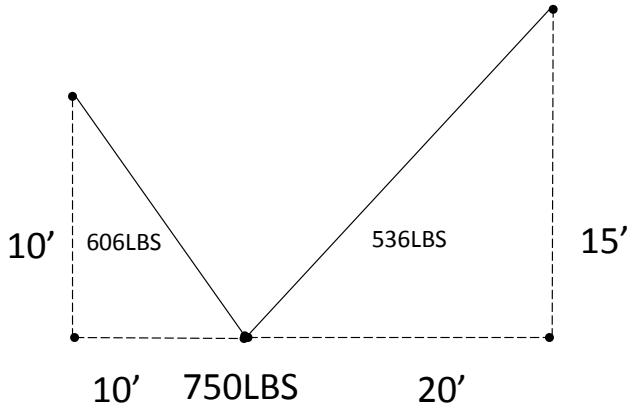
$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

$$F_H = \frac{(750)(10)(20)}{(10)(20) + (15)(10)}$$

$$F_H = \frac{150000}{350}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

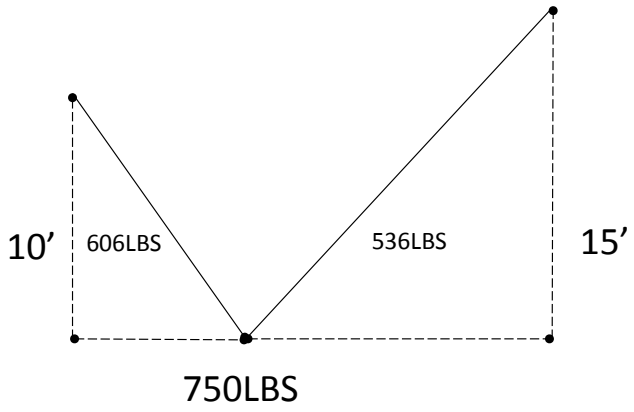
$$F_H = \frac{(750)(10)(20)}{(10)(20) + (15)(10)}$$

$$F_H = \frac{150000}{350}$$

$$F_H = 429LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

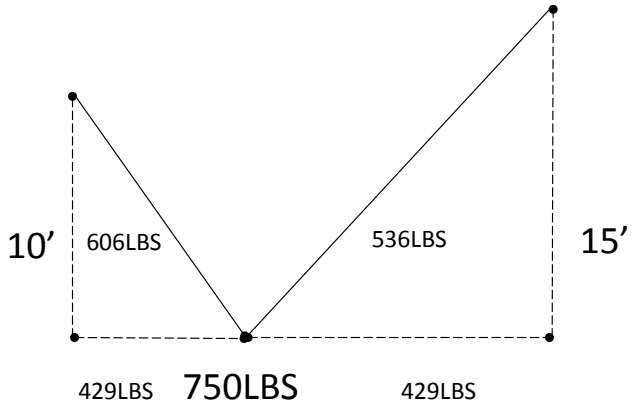
$$F_H = \frac{(750)(10)(20)}{(10)(20) + (15)(10)}$$

$$F_H = \frac{150000}{350}$$

$$F_H = 429LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_{1V}D_{2H} + D_{2V}D_{1H}}$$

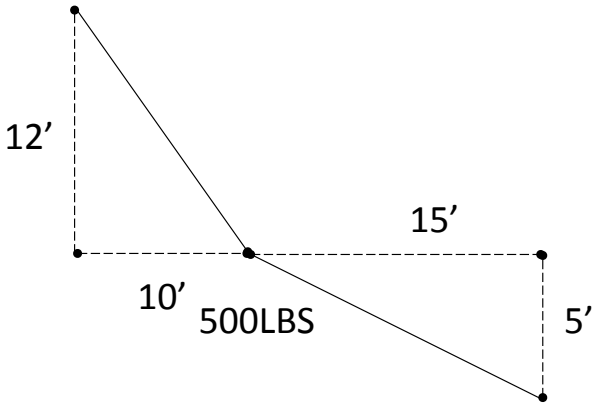
$$F_H = \frac{(750)(10)(20)}{(10)(20) + (15)(10)}$$

$$F_H = \frac{150000}{350}$$

$$F_H = 429LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC

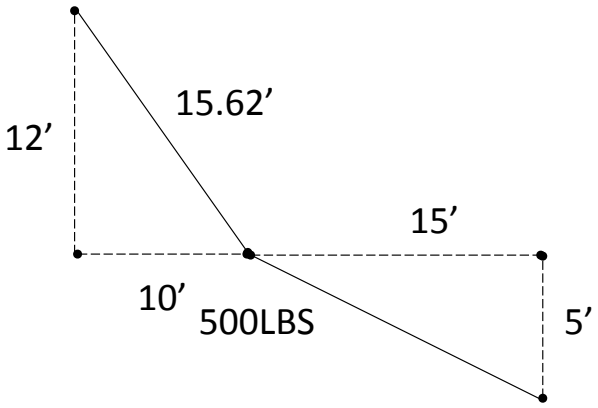
Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

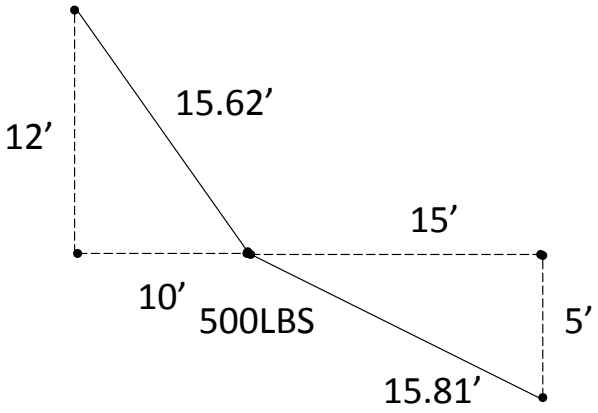
Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

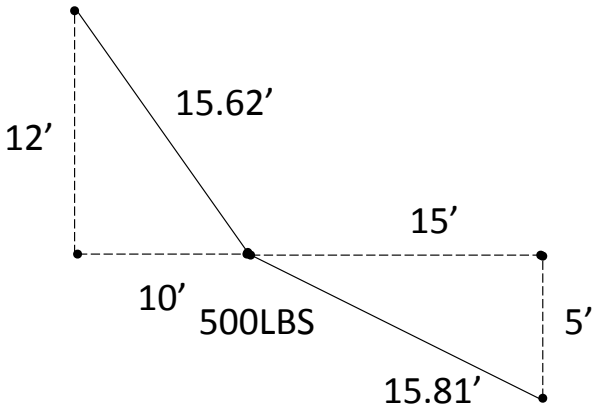
Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

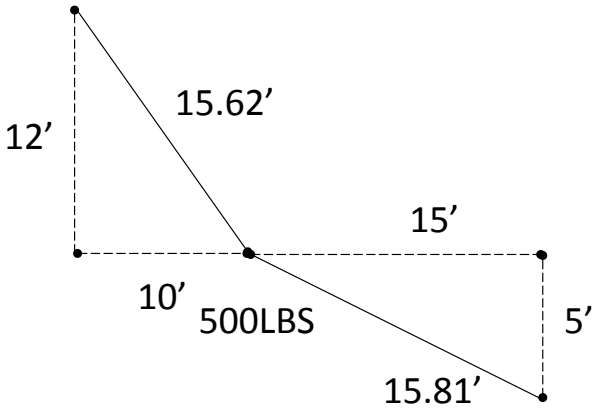


$$F_{1L} = \frac{(500)(15)(15.62)}{(12)(15) - (5)(10)}$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

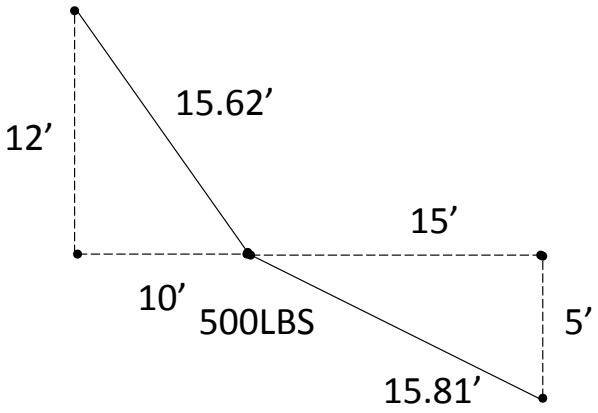
Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

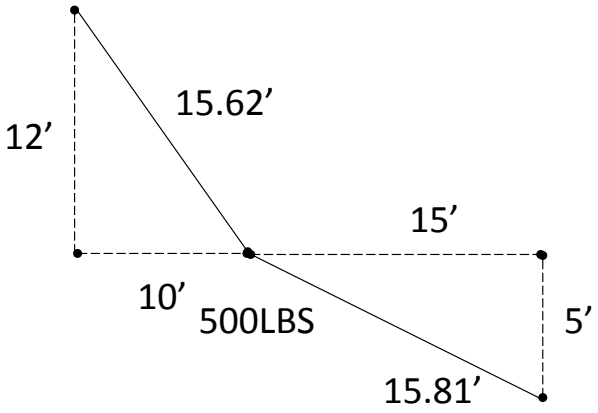


$$F_{1L} = 902LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



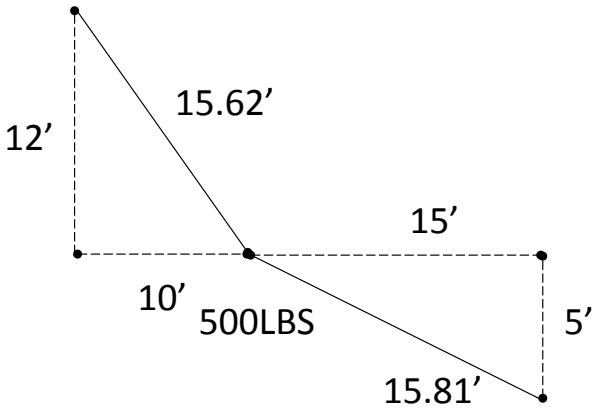
$$F_{1L} = 902LBS$$

$$F_{2L} = \frac{(500)(10)(15.81)}{(12)(15) - (5)(10)}$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

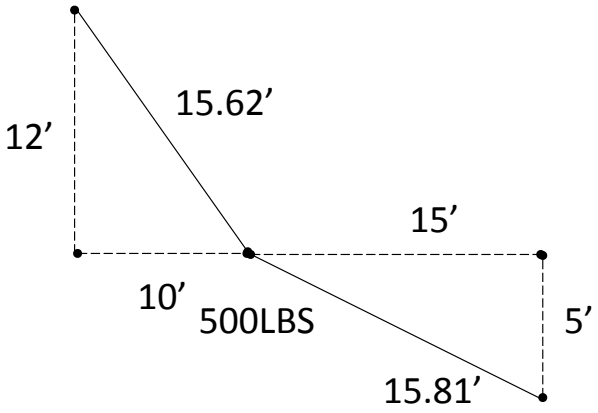


$$F_{1L} = 902LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



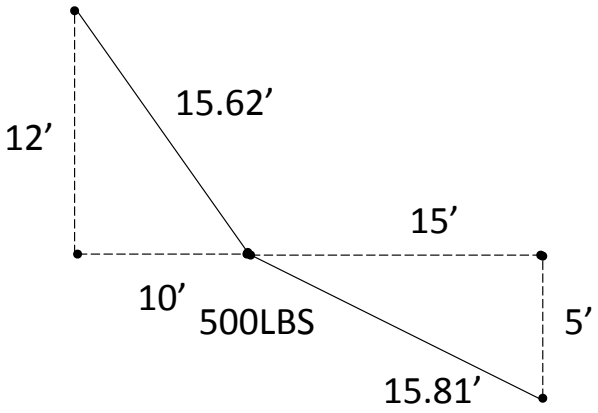
$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1L} = 902LBS$$

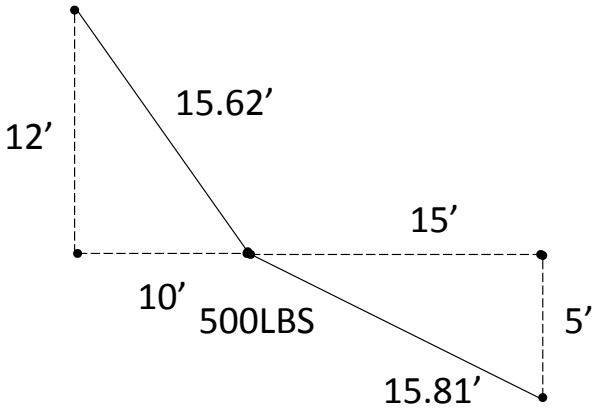
$$F_{2L} = 609LBS$$

$$F_{1V} = \frac{(500)(15)(12)}{(12)(15) - (5)(10)}$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



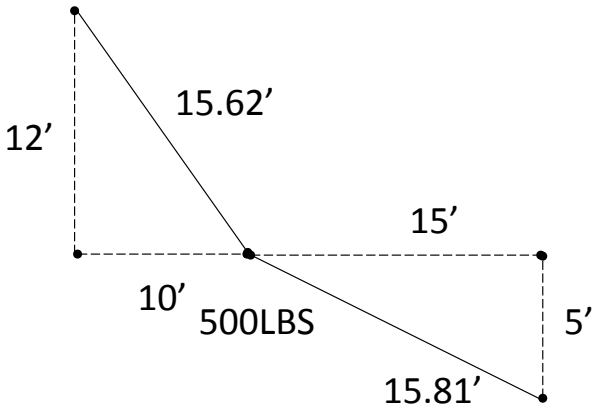
$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

$$F_{1V} = 693LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

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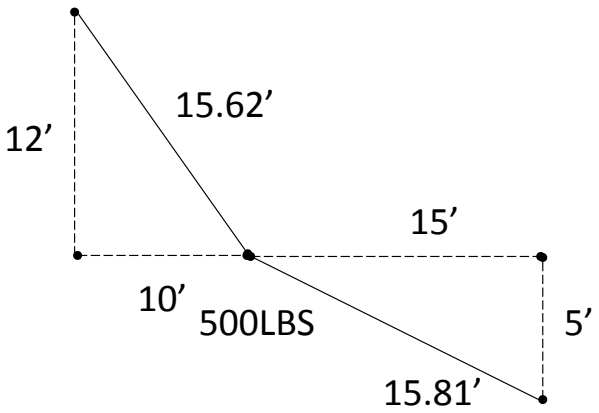
Math Solutions to Simple Bridles



$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

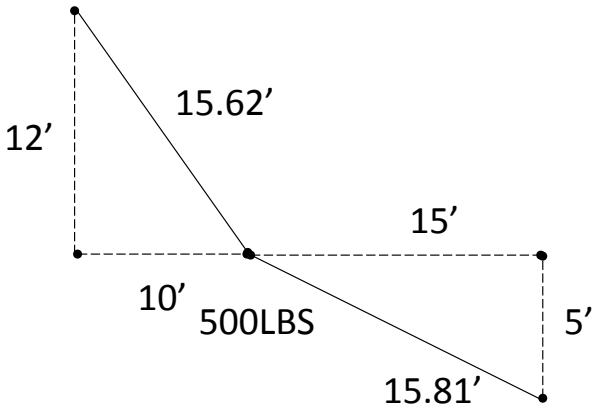
$$F_{1V} = 693LBS$$

$$F_{2V} = \frac{(500)(10)(5)}{(12)(15) - (5)(10)}$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

$$F_{1V} = 693LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

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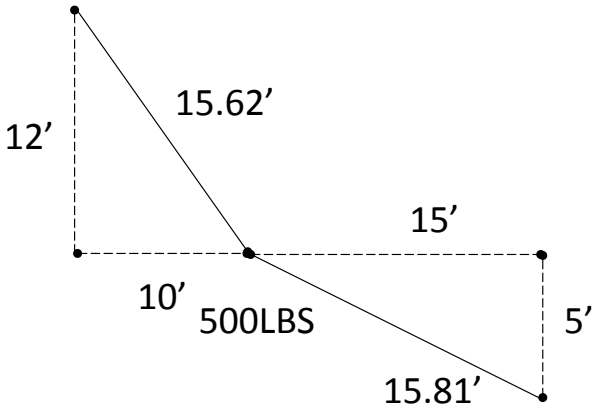
Math Solutions to Simple Bridles



$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

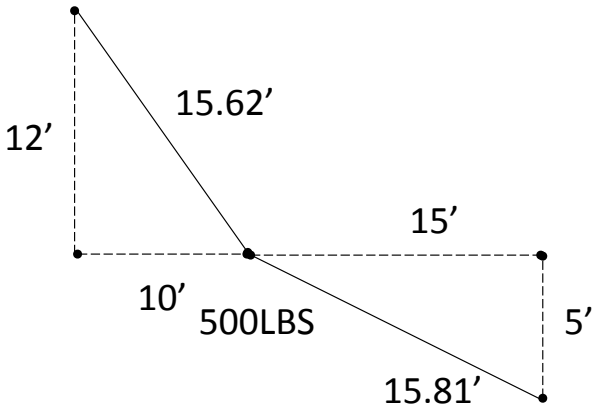
$$F_{1V} = 693LBS$$

$$F_{2V} = 193LBS$$

What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

$$F_{1V} = 693LBS$$

$$F_{2V} = 193LBS$$

$$F_H = \frac{(500)(10)(15)}{(12)(15) - (5)(10)}$$

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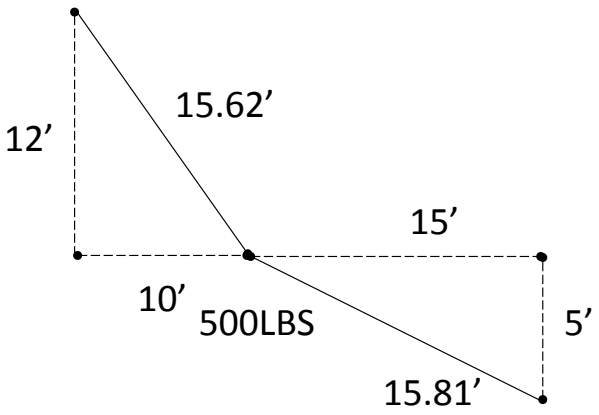
Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

$$F_{1V} = 693LBS$$

$$F_{2V} = 193LBS$$

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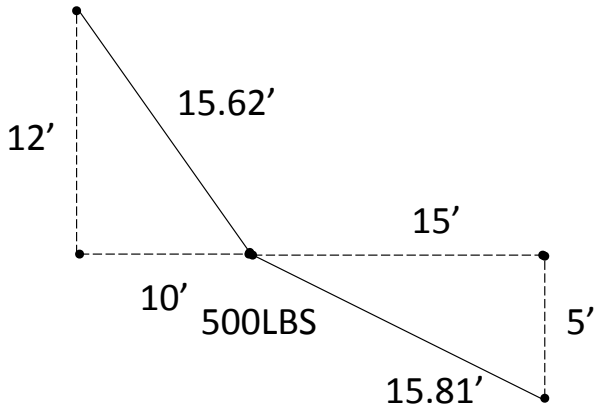
Math Solutions to Simple Bridles



What is Force on 1L, 2L, 1V, 2 V, and the Horizontal Force?

$$F_{1L} = 902LBS$$

$$F_{2L} = 609LBS$$

$$F_{1V} = 693LBS$$

$$F_{2V} = 193LBS$$

$$F_H = 577LBS$$

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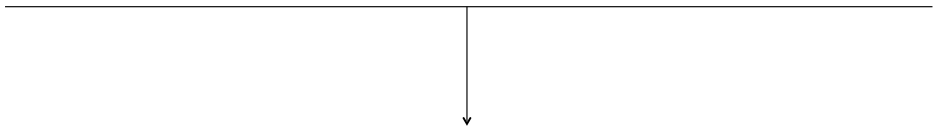
Math Solutions to Simple Bridles

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles



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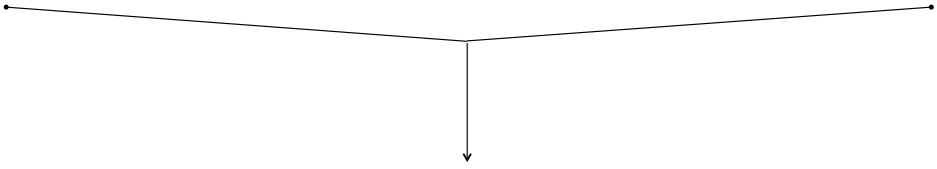
Math Solutions to Simple Bridles



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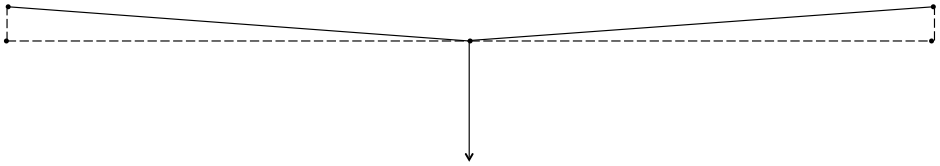
Math Solutions to Simple Bridles



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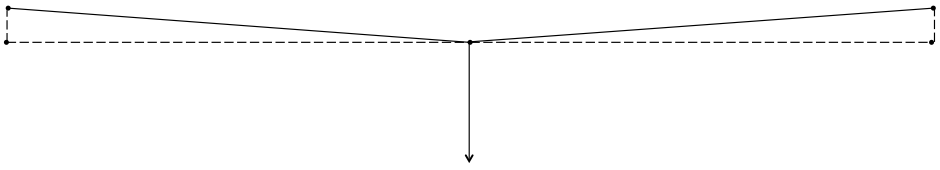
Math Solutions to Simple Bridles

40’ Deflection = 1/20 of span



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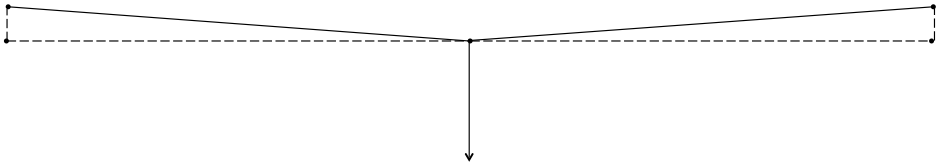
RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

2 Workers on this horizontal lift line.

40’ Deflection = 1/20 of span



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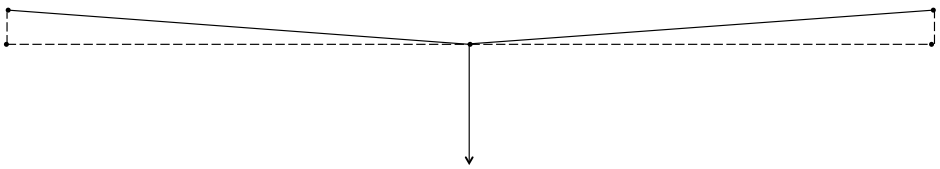
Math Solutions to Simple Bridles

2 Workers on this horizontal lift line.

40’ Deflection = 1/20 of span



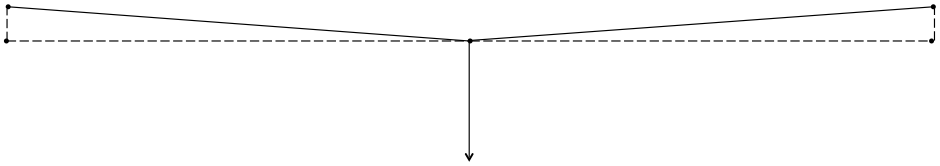
$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_V(Span)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

2 Workers on this horizontal lift line.

40’ Deflection = 1/20 of span



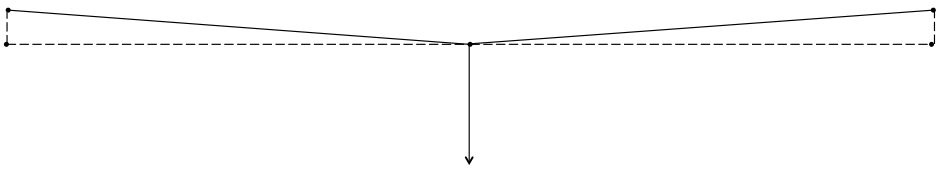
$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_V(Span)} \quad F_H = \frac{(3600(20)(20)}{2(40)}$$

ENTERTAINMENT RIGGING SERVICES, LLC

Math Solutions to Simple Bridles

2 Workers on this horizontal lift line.

40’ Deflection = 1/20 of span



$$F_H = \frac{(FA)D_{1H}D_{2H}}{D_V(Span)} \quad F_H = \frac{(3600(20)(20)}{2(40)} \quad F_H = 18,000LBS$$

ENTERTAINMENT RIGGING SERVICES, LLC