

Student Name \_\_\_\_\_

							Total
Criteria 1	0	8	16	24	32	40	
Criteria 2	0	8	16	24	32	40	
Criteria 3 & 4	0	4	8	12	16	20	

### MINI SITUATIONAL PROBLEM #1: A DINNER IN CAMELOT

King Arthur and his knights are planning on a large feast.

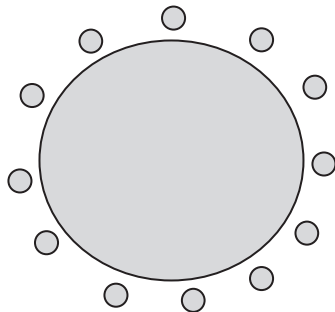
There are a total of twelve knights sitting at the table. 3 Blue, 3 Red, 4 Orange, Lancelot and King Arthur.

It was found that a Red knight eats one less dish than twice as many dishes as a Blue knight. An Orange knight eats three times as many dishes as a Red knight. Lancelot just ate, so he only had 3 dishes and King Arthur received five less dishes than all of the Blue knight's combined.

The court chief also realized that the total number of dishes could be found solving the equation provided on the right.

$$y - 15 = \frac{7y - 29}{8} \quad \text{by}$$

**How many dishes does each colour of knight, Lancelot and King Arthur eat?**



### Your solution: ANSWER KEY

$$\begin{aligned} \text{Let, } \# \text{ of dishes for a blue Knight} &= b \\ \# \text{ of dishes for a red Knight} &= 2b - 1 \\ \# \text{ of dishes for an orange Knight} &= 3(2b - 1) = 6b - 3 \\ \# \text{ of dishes for Lancelot} &= 3 \\ \# \text{ of dishes for King Arthur} &= 3b - 5 \end{aligned}$$

Solving the equation:

$$x - 15 = \frac{7x - 29}{8}$$

$$\begin{aligned} 8x - 120 &= 7x - 29 \\ \underline{\quad + 120 \quad} &\quad \underline{\quad + 120 \quad} \\ 8x &= 7x + 91 \\ \underline{-7x \quad -7x} & \\ x &= 91 \end{aligned}$$

3 blue Knights + 3 red Knights + 4 orange Knights + Lancelot + King Arthur = total no. of dishes

$$3b + 3(2b - 1) + 4(6b - 3) + 3 + 3b - 5 = 91$$

$$3b + 6b - 3 + 24b - 12 + 3 + 3b - 5 = 91$$

$$36b - 17 = 91$$

$$\underline{\quad + 17 \quad} \quad \underline{\quad + 17 \quad}$$

$$36b = 108$$

$$\underline{36} \quad \underline{36}$$

$$b = 3$$

$$\begin{aligned} \# \text{ of dishes for a blue Knight} &= b = 3 \\ \# \text{ of dishes for a red Knight} &= 2b - 1 = 2(3) - 1 = 5 \\ \# \text{ of dishes for an orange Knight} &= 6b - 3 = 6(3) - 3 = 15 \\ \# \text{ of dishes for Lancelot} &= 3 \\ \# \text{ of dishes for King Arthur} &= 3b - 5 = 3(3) - 5 = 4 \end{aligned}$$

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### MINI SITUATIONAL PROBLEM #2: A GIFT TO THE QUEEN

Legend has it that in ancient India, a farmer saved a Queen from kidnappers. In return the Queen offered the farmer one wish.

The farmer humbly accepted the Queen's offer but gave her three options of repayment in rice to feed his village.

**Option 1** – If the Queen placed one grain of rice on the first tile and doubled that number on the second tile, then doubled that new number on the third tile, he'd like the number of grains of rice on the 25<sup>th</sup> tile.



**Option 2** – He would like a grain of rice for the total number of seconds there are in 1 year.

**Option 3** – He would like the number of grains of rice corresponding to the numerical value of  $\frac{(x^2)^5(x^2)^3}{(x^3)^3}$ . He

suggested to her, she could find the value of x first, from the equation.  $6x - 12 = 4x + 10$ .

**Which option gives the farmer the most grains of rice? Provide you answers for each option in scientific notation.**

### Your solution: ANSWER KEY

#### Option 1

Tile	No. of grains	Power of 2
1	1	$2^0$
2	2	$2^1$
3	4	$2^2$
4	8	$2^3$
5	16	$2^4$
...	...	...
25		$2^{24}$

$$2^{24} = 16\,777\,216 = \underline{1.677\,721\,6 \times 10^7 \text{ grains of rice}}$$

#### Option 2

1 year x 365 days/year x 24 hours/day x 60 minutes/hour x 60 seconds/minute

$$= 31\,536\,000 = \underline{3.153\,6 \times 10^7 \text{ grains of rice}}$$

#### Option 3

Solving the equation

$$\begin{aligned} 6x - 12 &= 4x + 10 \\ &\quad +12 \quad \quad +12 \\ 6x &= 4x + 22 \\ -4x &\quad -4x \\ \underline{2x} &= \underline{22} \\ \frac{2x}{2} &= \frac{22}{2} \\ x &= 11 \end{aligned}$$

$$\text{Simplifying } \frac{(x^2)^5(x^2)^3}{(x^3)^3} = \frac{x^{10} \cdot x^6}{x^9} = \frac{x^{16}}{x^9} = x^7$$

$$x^7 = 11^7 = 19\,487\,171 = \underline{1.948\,717\,1 \times 10^7 \text{ grains of rice}}$$

The best option is option 2.

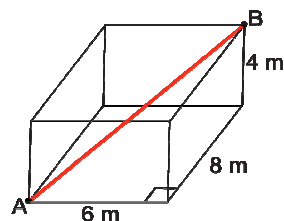
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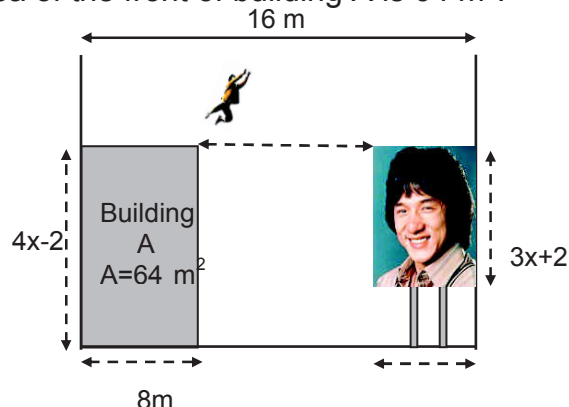
### MINI SITUATIONAL PROBLEM #3: JACKIE'S STUNTS

Jackie Chan is considering 2 new stunts for his upcoming movie.

**Stunt 1 – Rope Climb** In this stunt, Jackie balances on a rope going from point A to point B. Jackie can only do this stunt if he makes it in under 5 seconds. He can run a maximum of 2.5 m/s on the rope.



**Stunt 2 – Building to Sign Jump**- In this stunt, Jackie jumps from the roof of a building onto a giant sign of himself. From experience, we know Jackie can only jump a maximum horizontal distance of 4 m. The perimeter around the sign is 28 m and the area of the front of building A is  $64 \text{ m}^2$ .



Can Jackie Chan safely complete these stunts?

### Your solution: ANSWER KEY

**Stunt 1:** Using the Pythagorean Theorem to find the length of the rope:

$$\text{Diagonal of the bottom rectangle} = \sqrt{6^2 + 8^2} = 10 \text{ m}$$

$$\text{Length of the rope} = \sqrt{10^2 + 4^2} \approx 10.770 \text{ m}$$

$$\text{Time to climb the rope} = \frac{\text{distance}}{\text{speed}} = \frac{10.770 \text{ m}}{2.5 \text{ m/s}} \approx 4.31 \text{ seconds}$$

**4.31 seconds is less than 5 seconds, so yes this stunt can be completed safely.**

**Stunt 2:** Solving for x (building A)

$$\text{Area} = \text{length} \times \text{width}$$

$$64 = 8(4x - 2)$$

$$64 = 32x - 16$$

$$\begin{array}{r} +16 \quad +16 \\ \hline \end{array}$$

$$\frac{80}{32} = \frac{32x}{32}$$

$$2.5 = x$$

$$\underline{x = 2.5}$$

$$\text{Height} = 3x + 2 = 3(2.5) + 2 = 9.5$$

$$\text{Perimeter} = 2(\text{width}) + 2(\text{height})$$

$$28 = 2w + 2(9.5)$$

$$28 = 2w + 19$$

$$\begin{array}{r} -19 \quad -19 \\ \hline \end{array}$$

$$\frac{9}{2} = \frac{2w}{2}$$

$$4.5 = w$$

$$\text{Distance between building and sign: } 16 - 8 - 4.5 = 3.5 \text{ m}$$

**3.5 meters is less than 4 meters, so yes this stunt can be completed safely.**