CONFERENCE FOR MATHEMATICS TEACHERS

AME – SMS  **Conference 2013**

Theme: Learning Experiences in Mathematics

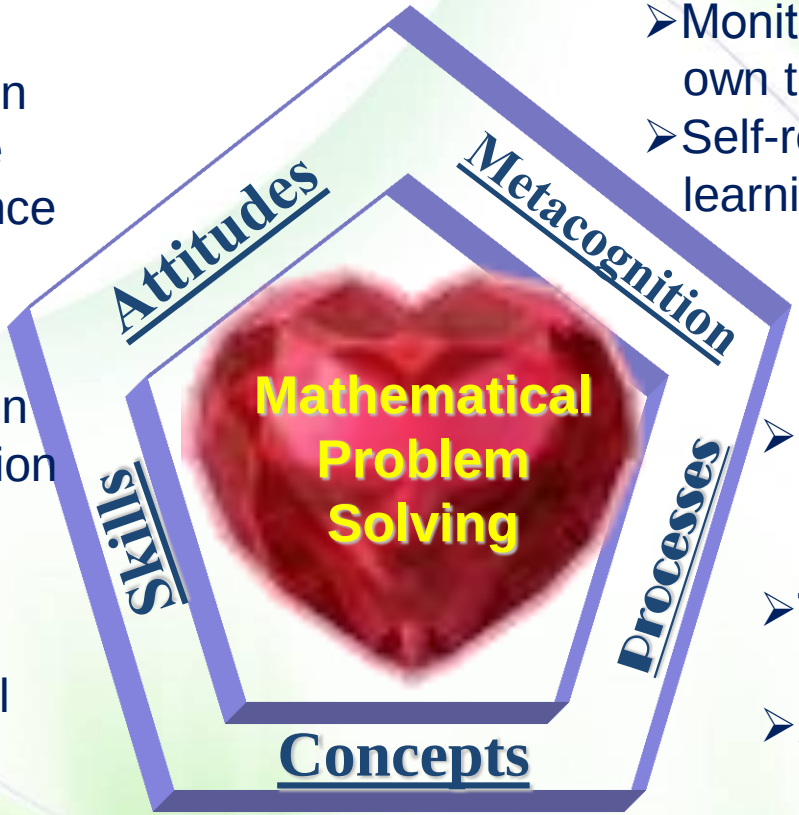
Learning concepts of numbers through exploration and connections

6th June, 2013@NUS High School, Singapore

Singapore Mathematics Framework

- Beliefs
- Interest
- Appreciation
- Confidence
- Perseverance

- Monitoring of one's own thinking
- Self-regulation of learning



- Numerical calculation
- Algebraic manipulation
- Spatial visualisation
- Data analysis
- Measurement
- Use of mathematical tools
- Estimation

- **Reasoning, communication & connections**
- **Thinking skills & heuristics**
- **Applications & modelling**

- Numerical , Algebraic
- Geometrical, Statistical
- Probabilistic, Analytical

Syllabus Organisation [2013]

- 3 content strands + 1 _____

Number and Algebra	Measurement and Geometry	Statistics

Learning Experiences (LE)

- Enhance *conceptual understanding* through use of the CPA approach & various mathematical tools including ICT tools'
- Apply concepts and skills learnt in real-world context
- *Communicate* their *reasoning and connections* through mathematical *tasks* and *activities*
- Build confidence and foster interest in mathematics

CPDD_Primary Mathematics Teaching and Learning Syllabus (2012)

Notion of Mathematical proficiency

-conceptual understanding
-procedural fluency
-strategic competence
-_____
-productive disposition

"_____" is the glue that holds everything together

- allows for concepts and procedures to _____in sensible ways
- suggests possibilities for problem solving and
- allows for disagreements to be settled in reasoned ways

Kilpatrick, et al. (2001)

LE through Investigations

- Investigations help pupils to develop mathematical concepts and provide pupils with experiences of some of the processes through which mathematical ideas are generated or tested *(Australian Education Council, 1991, p. 14)*

- Mathematics teaching at all levels should include opportunities for … investigational work *(UK, Cockcroft, 1982, p. 71).*

Samples of Mathematical Investigations or

- Investigative tasks/activities

Concept of Factors & Multiples

TASK I

- Use the CPA approach
- Find a connection for factors and multiples

Exploring a connection

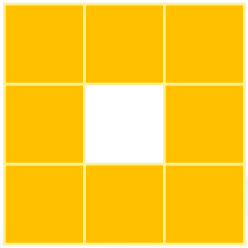
Introducing the concept Factors and Multiples

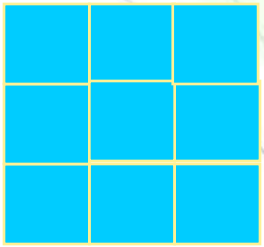
Objectives

- To deduce the patterns of arrangement of given numbers through concrete manipulatives
- To establish a link between the arrangements and the required concept of factors and multiples

Instructions:

- Arrange the tiles (with sides touching each other) in as many ways as you could for each of the numbers {





- Observe any emerging pattern from the arrangement/s each given number

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Guiding Questions

Observing Patterns to make Connections

No.	No. of different arrangements	No. of _____	No. of _____	Remarks
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Conclusion:

Put on your thinking cap!

- What _____to all the arrangement for each given number?
- Some numbers have more than one shape. Name them.
- Is there a _____between the shapes with the given number?
- Let's look at the _____found for each number! What have you found?

Picture credit: http://findicons.com/search/question

Investigative Task on Factors

TASK II

1. Take any number from 1 to 99.
2. Write down all the factors (including the number *1* and *itself*).
3. *Add* up *all the digits*.
4. Repeat the process on the *digit sum* and keep going until you think you should stop.
5. Present your work explicitly. {*You may think of how to display it aesthetically appealing*}.

- *Repeat steps 1 to 4 with 3 other numbers*

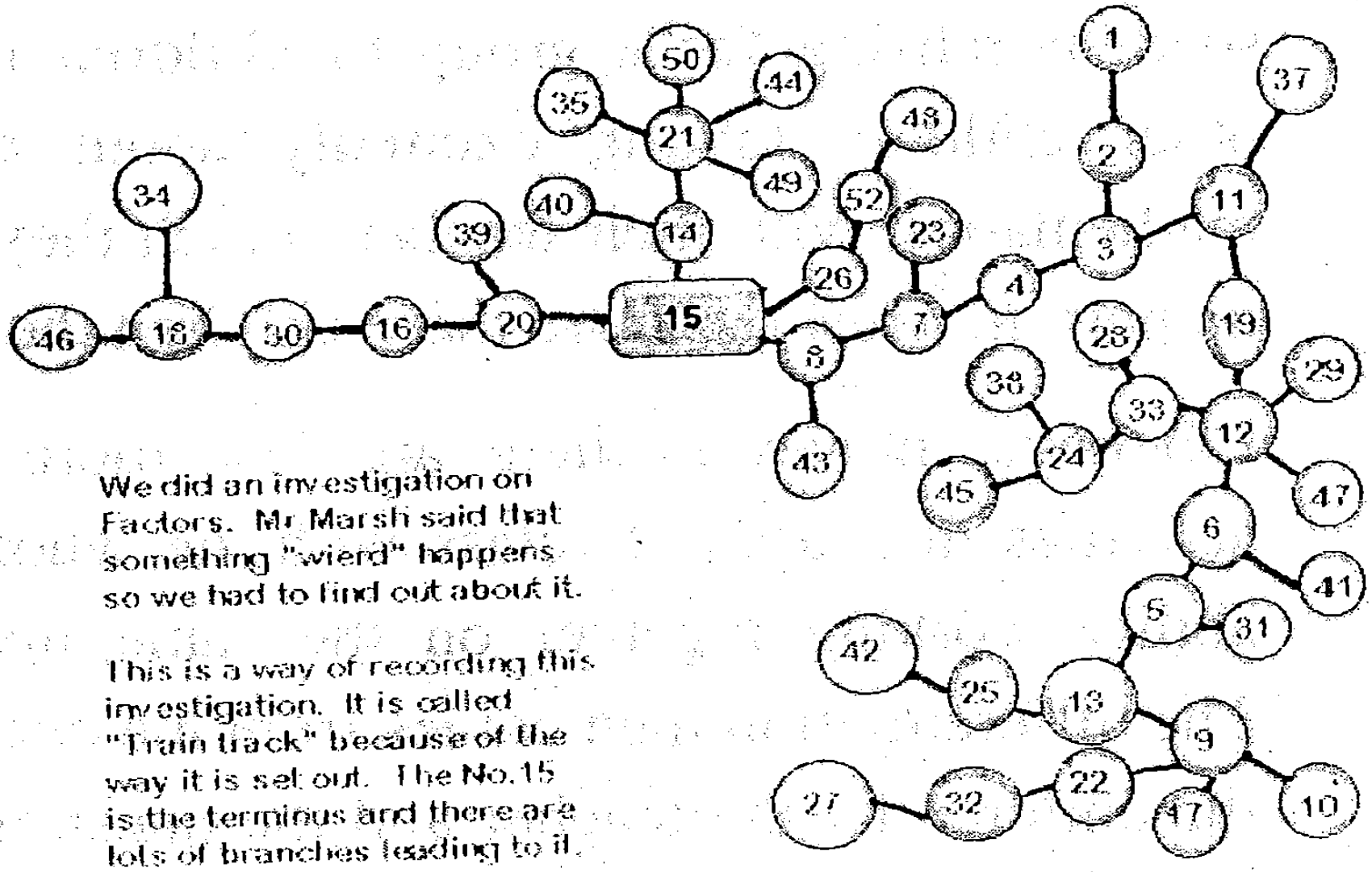
Equals_Vol. 4 No. 3_Autumn (1998) by Martin Marsh

Put on your thinking cap!

- Do you know when you should stop?
- Have you verified with ***at least 3 different*** numbers?
- Could you explain your representations of your work?

Picture credit: http://findicons.com/search/question

Maria's Solution – Martin's Student



We did an investigation on Factors. Mr Marsh said that something "wierd" happens so we had to find out about it.

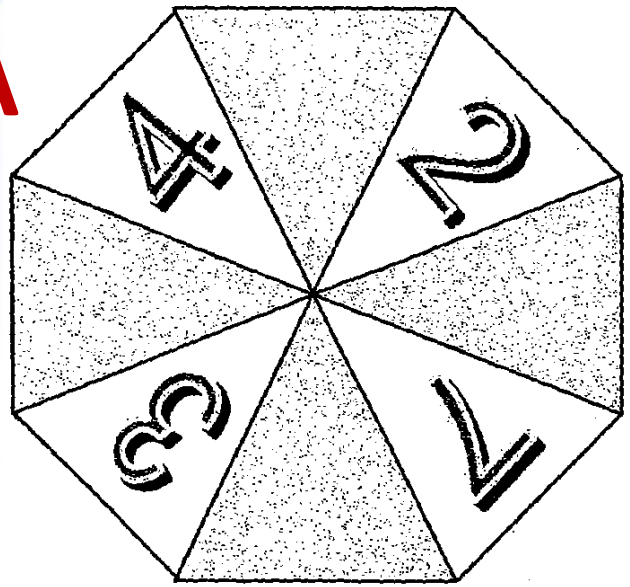
This is a way of recording this investigation. It is called "Train track" because of the way it is set out. The No.15 is the terminus and there are lots of branches leading to it.

Key: —— = train track (n) = train stop [15] = terminus

Operations on Numbers

WARMING UP

A



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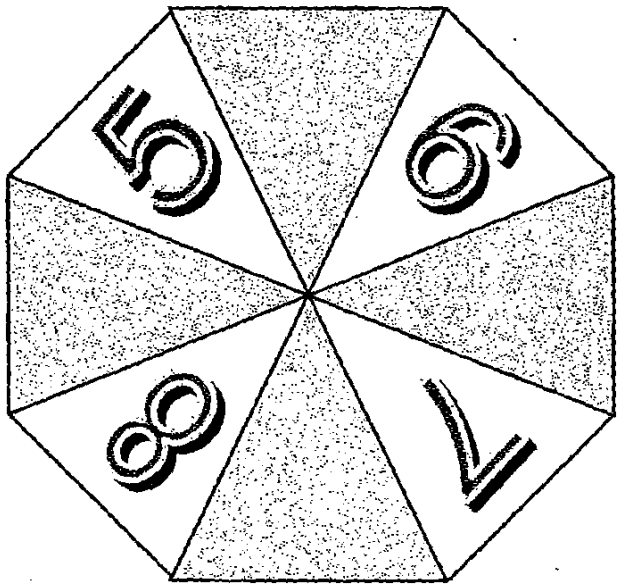

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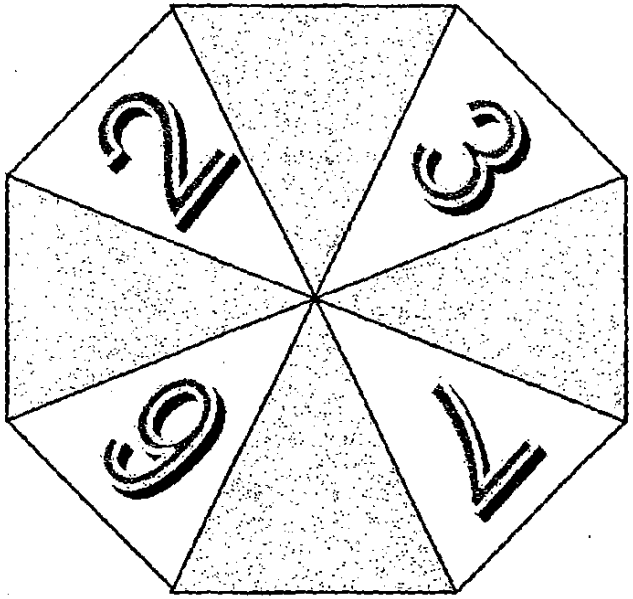


By John Berry, uk

Making ___ using the operations

addition, subtraction, multiplication and/ or division

Use all four numbers only once!

The Story of ___

Developing the teaching of practical tasks; provide opportunities to

- work with arithmetic ***operations and properties*** of numbers
- ***do***, ***communicate*** (orally and written), ***construct***, ***record*** via words (correct use of mathematical terms/notations), display information via diagrams/pictures/graphs, ***make connections***
- Develop pupils' ***thinking & reasoning skills***, ***flexibility***, creativity, imagination, perseverance

The Story of ___

TASK IIIA

- Where do you ***see and hear*** about the number ___in your daily life context?
- Brainstorm for ideas over a day or two
- Produce a poster of all your ideas and linking them

The Story of ___

TASK IIIB

- Use some ***sentence starters:***

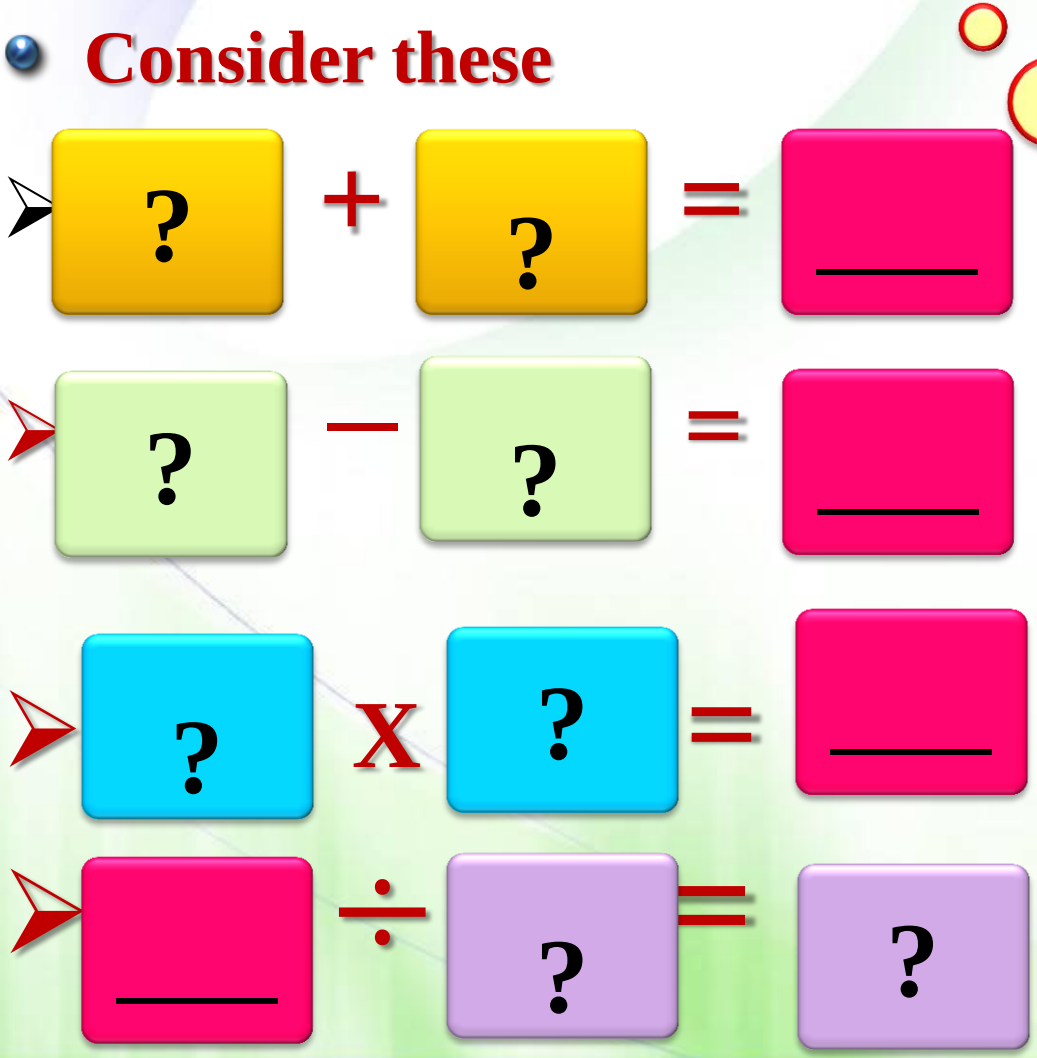
___is an even number.

- ***___is a multiple of …***
- ***___is a product of …***
- ***___is greater than …***
- ***___is not equal to …***
- ***___cannot be divided by …***
- ***___has the following factors…___can be divided by …***
- ***___is the sum of …***
- ***___is not a … or …odd number ; etc***

The Story of ___

TASK IIIC

- Developing and extending Mathematical statements
- **Consider these**



The Story of ___

TASK IIID

- Some ***novel statements for ___using squares, $\sqrt{\ }$, $\sqrt[3]{\ }$, fractions, decimals,or*** !

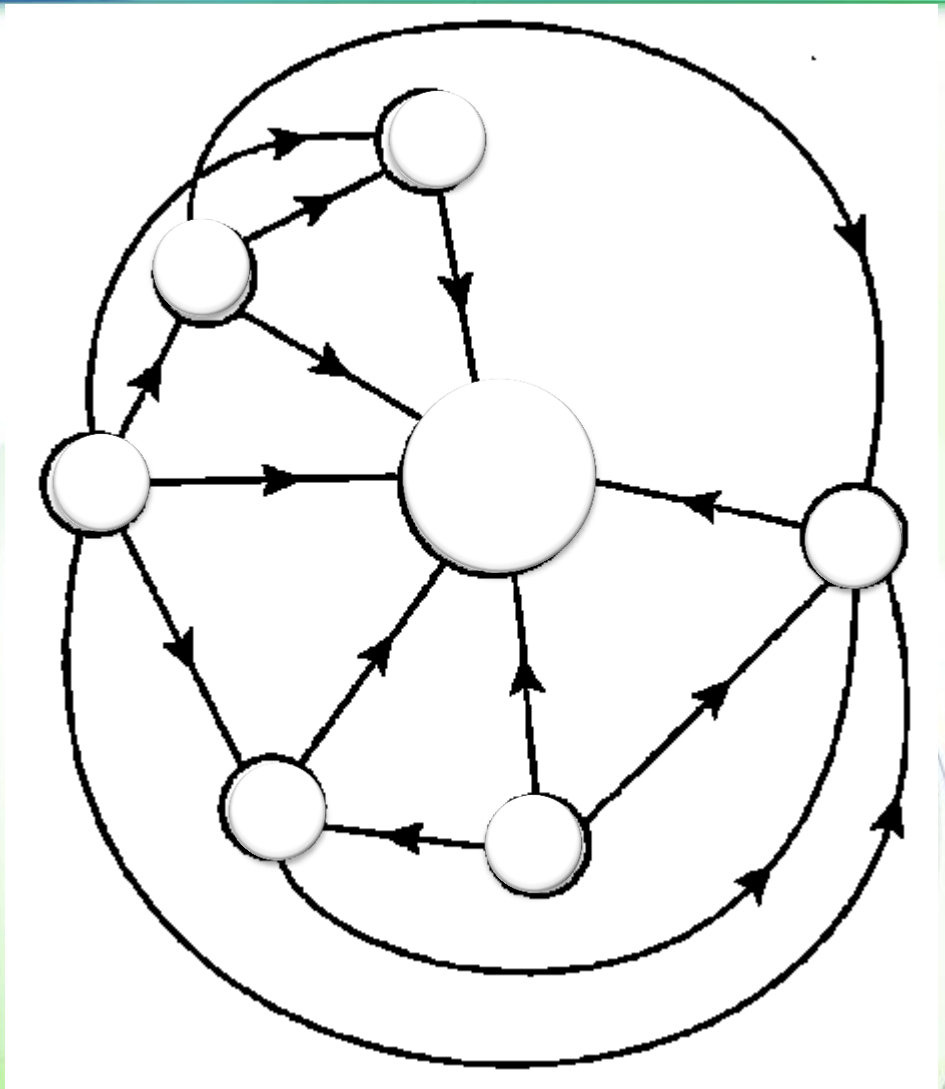
- Put the problem in a real-life context using ***local denominations of money/stamps, game scores, etc.***

➢ Making a **sum of ___**

The Story of ___

TASK IIIE

- Consolidate on concept of ***factors and multiples*** by ***completing*** this ***network of ___.***
  - Do not forget to include a ***key/legend*** to explain your diagram.



The Game of ___

TASK FOR YOUR PUPILS

Using all four numbers

, , and

___, __,__ and __, but *using each number only once*, how many different ways of getting the answer ___by adding, subtracting, multiplying and dividing (they may use ***squares,*** $\sqrt{\ }$, $\sqrt[3]{\ }$ too!).

http://nrich.maths.org/public/leg.php?code=32&cl=2&cldcmpid=1129

Picture credit: Download the Office.com ActiveX Control

Calendar Mathematics

http://www.youtube.com/watch?v=JNDQtlYcevw

- **Objectives:**
- Provide computational practice
- Develop an awareness of number patterns on the calendar
- Verbalise (communicate using correct mathematical language and terms) their findings.

Let's crunch numbers!

TASK IVA

$$\frac{13}{}$$

Newspaper: a source for applications in Mathematics

- A useful instructional aid which offer valuable applications of mathematics to supplement day-to-day instruction.

- Supermarket bargains –best buy
- Coupons cut-out
- Weekly food shopping trek : *estimation*
- Shopping spree – given sum must buy 10 designated items

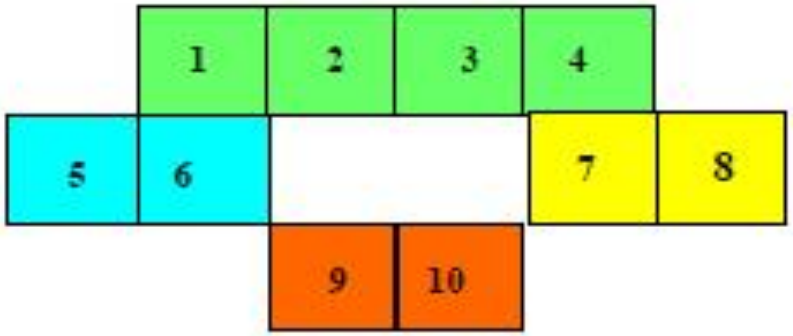
- Bargain collages: sales price|& discount %
- Classified advertising pages - % and rates
- Car pricing – total cost for purchasing cars; instalment & interest; consumption of petrol, etc.

- Home furnishings – sum set , buy items to fit space of living room, etc
- Pricing – determine cost per square metre
- Renting versa buying a home

- TV time –time spent per day over one week
- Weather/tides – chart high and low Renting versa buying a home
- Sports statistics

The Given *Stem*

- Design an Mathematics Investigative Task – to **introduce or consolidate a topic taught.** You may use some of or all the information together with those of your own.



Task or Activity

- Provide opportunity for students to work collaboratively.

  By tapping on each other's experiences and talking about the investigative task, they are

  - engaged in reflecting, conjecturing, and justifying.

- Hiebert, Carpenter and Fennema put it that students

  - who reflect on what they do and
  - communicate with others are in the

  _____