Time Together

Task 22 ... Years 2 - 10

Summary

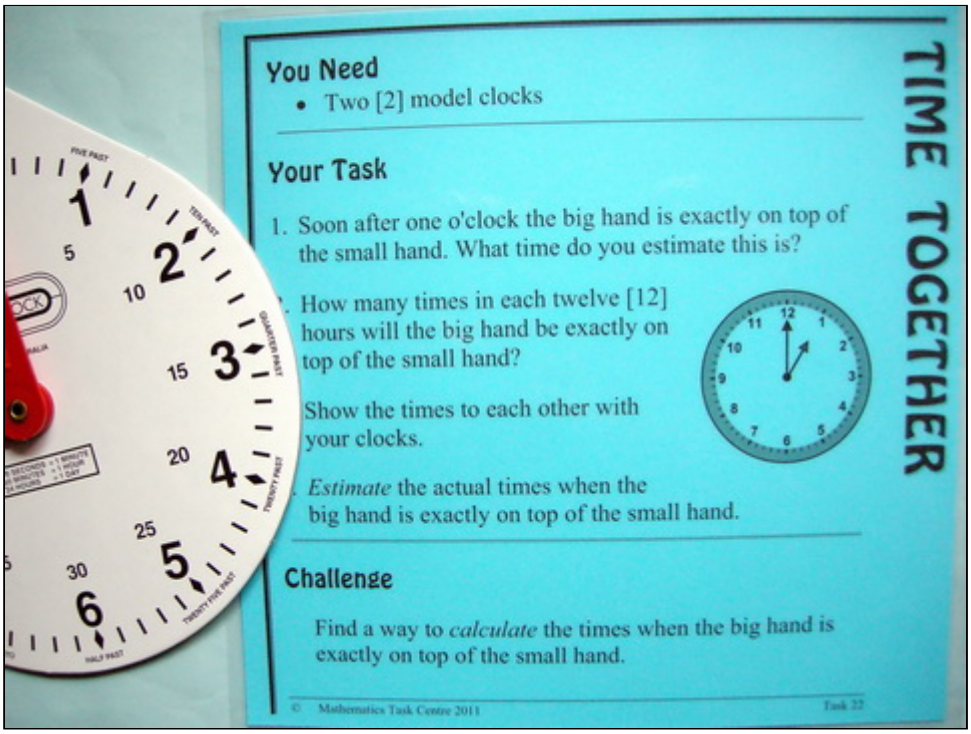
A task to help students explore the passing of time. The focus is on those moments in a 12 hour cycle when the hands are 'on top of each other'. The task encourages manipulation of the clock hands (an activity not often part of students' daily lives these days), estimation and, for the more mathematically mature, precise calculation. The task also offers experience with the meaning of *clockwise* and opportunity for informal learning related to counting, angles and fractions.

Materials

- Two clock faces

Content

- division of time into hours, minutes and seconds
- visualising the passing of time
- applying understanding of the interconnectedness of the hands of a clock
- visualising angles
- clockwise & anti-clockwise
- counting patterns
- proportional reasoning
- fractions related to elevenths and twelfths
- graphical representation of simultaneous linear equations



Iceberg

A task is the tip of a learning iceberg. There is always more to a task than is recorded on the card.

Part of the iceberg of this task is generated by the discussion related to deciding when the hands coincide. This will bring many opportunities to introduce or confirm language and facts related to clock time. Estimation is an important component because it allows for solution at a range of levels. Less experienced

students may well make a first estimate of 12:00, 1:05, 2:10, 3:15 and so on. Checking can easily become their responsibility by either watching the class clock, or using a clock with connected hands.
(NB: NOT using such a clock in the first place is one of the elements which promotes discussion and encourages students to draw on previous knowledge.)

There are 11 times in a 12 hour period when the hands coincide, estimates of those times involves considerable thought and discussion, but calculating them can be more complex. Approaches might be:

1. We know the hands coincide at 12:00. Before this can happen again, the minute hand has to go right around the circle (360º) AND pass through an extra angle to catch up with the slower moving hour hand.

   The minute hand sweeps through angles at a rate of $360t^{o}$ where t is measured in hours.

   The hour hand sweeps through angles at a rate of $30t^{o}$

   So, to meet the hour hand the first time after 12:00, the minute hand has to first sweep out 360º to get back to 12:00 and then sweep the extra angle the hour hand has been and still is, travelling. They will coincide when:

   $$360t = 30t + 360$$
   $$330t = 360$$
   $$t = {}^{360}/_{330} = {}^{12}/_{11}$$

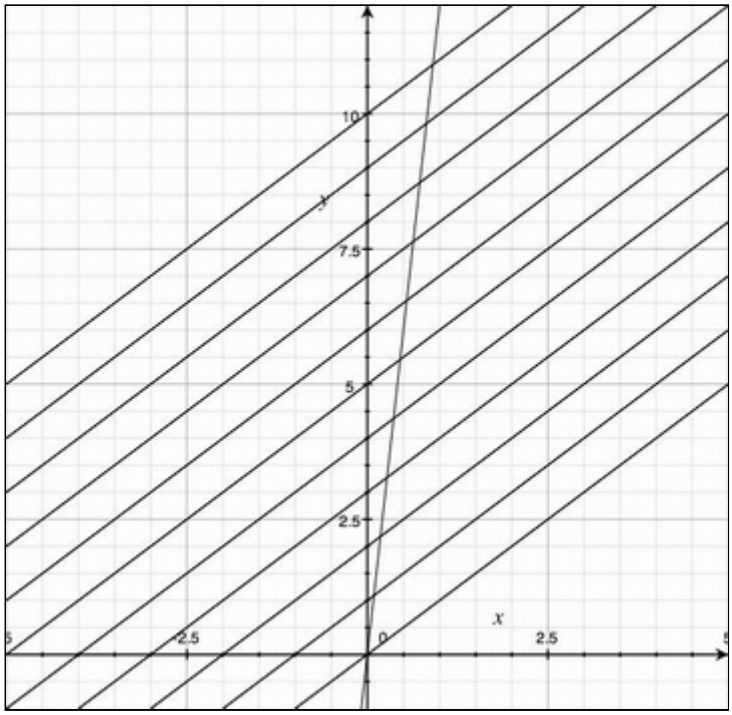
   So the hands meet $1{}^{1}/_{11}$ hours after 12:00, then $1{}^{1}/_{11}$ hours after that, then $1{}^{1}/_{11}$ hours after that, then $1{}^{1}/_{11}$ hours after that etc. up to 11 occasions.

2. Another approach, perhaps more elegant, was submitted by Steve Flavel. First realise that the 11 occasions are equally spaced around the clock face. Therefore, simply dividing 60 divisions (minutes) of the clock face by 11 gives the number of divisions between each coincidence, ie: $5{}^{5}/_{11}$. Given that one time when the big hand is on top of

the small hand is 12:00, the others can be calculated by adding multiples of $5\frac{5}{11}$.

The solutions can now be calculated to any level of accuracy - minutes; minutes and seconds; minutes, seconds and hundredths of second etc.

3. Steve has also contributed this graphical solution.



What would happen if we had metric time? Suppose a metric clock face had only 10 hours and suppose there were 100 metric minutes in every metric hour. On how many occasions would the big hand be on top of the small hand? Estimate, then calculate those metric times.

Note: This investigation has been included in Maths At Home. In this form it has fresh context and purpose and, in some cases, additional resources. Maths At Home activity plans encourage independent investigation through guided 'homework', or, for the teacher, can be an outline of a class investigation.

- Visit the Home Page for more Background.
- For this specific activity click the Learners link and on that page use Ctrl F (Cmd F on Mac) to search the task name.

Whole Class Investigation

Tasks are an invitation for two students to work like a mathematician. Tasks can also be modified to become whole class

If you don't have access to many model clocks such as those in the task, the best thing is to do a preliminary lesson in which students make their own clock. This is a

investigations which model how a mathematician works.

wonderful activity at virtually all age levels because it highlights current understanding and requires considerable problem solving such as how to place the 12 numbers around the circumference of the circle, or indeed, how to find the centre of the circle. The more accurate you want to be in solving this problem, the more you need to call on increasingly sophisticated mathematical tools.

Paper plates or margarine lids can provide the clock faces. Split pins can centre the hands. Clocks can be personalised by adding decoration.

Another way to organise enough analogue clocks for everyone is to use the partner Maths At Home lesson as a homework project. It is supported by a recording sheet of clock faces which you can hand out as take home sheets and is easily accessed on line from anywhere. Directions are as clear and simple as the card. Learners are encouraged to choose a family member or friend as a partner.

At this stage, *Time Together* does not have a matching lesson on Maths300. However, a starting point for designing a personal clock face might be to use the Maths300 lesson *Hunting For Stars* with the software support set at 12 people around the circle. Circles with stars can be printed directly from this lesson. The lesson might also stimulate you to build a 'giant' clock on the classroom floor, something like the floral clocks sometimes found in public gardens.

Another Maths300 lesson which can support learning related to clocks is Fraction Estimation. This lesson is extensively supported by software. Option 3 divides a circle into parts and counts the fraction parts requested. By setting the Change Fractions button of the option to use only twelfths, every challenge offered by the software is equivalent to reading a clock face. Students are asked to drag a coloured section of the clock a given number of twelfths and can visualise the solution by looking at a clock face on the wall.

Is it in Maths With Attitude?

Maths With Attitude is a set of hands-on learning kits available from Years 3-10 which structure the use of tasks and

Time Together is not in any MWA kit. However it can be used to enrich the *Chance & Measurement* kit at Years 3/4 and the Number & Computation kit at Years 9/10.

whole class investigations into a week by week planner.

Follow this link to Task Centre Home page.