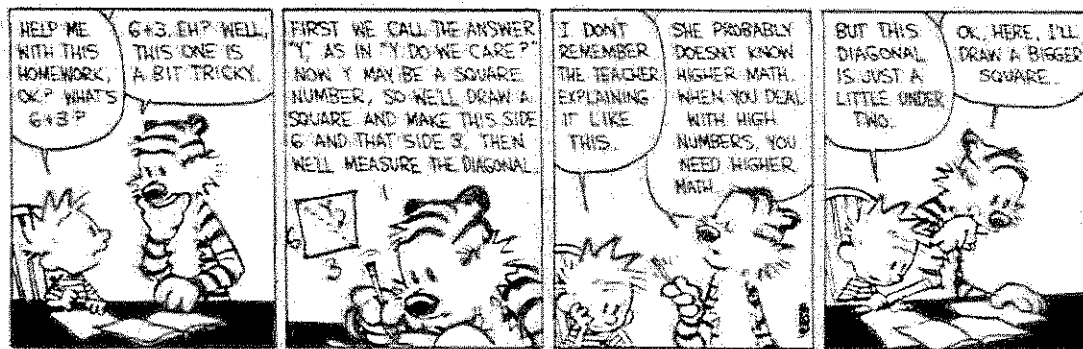


Name: SolutionsSignature: SolutionsDate: 9 October 15.

Do not start this exam until instructed; you will have 50 minutes to finish the exam. No notes, books, calculators, phones or electronic devices are allowed on this exam. If you have a question, raise your hand; otherwise, there is no talking during the exam.

There are 10 problems on this exam on 5 pages, in addition to this cover page. The point values of each problem vary, but are listed in the questions.

Good luck!



From Calvin and Hobbes.

1. (2+2+2+2+2+2=12 points) For the following problems, no work is necessary - just give the answer.

(a) Give the definition of a circle.

Choose a point P & distance R . The circle w/ center P & radius R is the set of all points distance R from P .

(b) Give the definition of a trapezoid.

A quadrilateral in which one and only one pair of opposite sides are parallel.

(c) Draw a figure with rotational symmetry of order 6.



or



or



(d) Determine whether the following "if... then" statement is true. Then write the converse and determine whether the converse is true.

If a figure is a parallelogram, then it is a rhombus.

Not True.

Converse: If a figure is a rhombus, then it is a parallelogram.

True.

(e) Describe the three steps in the teaching sequence for measurements.

- 1) Direct comparison, simple non-standard unit, standard unit.
- 2) Bigger / smaller standard units, conversions.
- 3) Problem solving.

(f) What is the measure of an interior angle in a regular 6-gon?

$$\text{Sum of angles} = 180(6-2) = 180(4) = 720^\circ$$

$$6 \text{ equal angles} \rightarrow 720^\circ / 6 = \boxed{120^\circ}$$

2. (3+3+3=9 points) For the following problems, mark true or false. No work is necessary.

All pentagons are convex.

True False

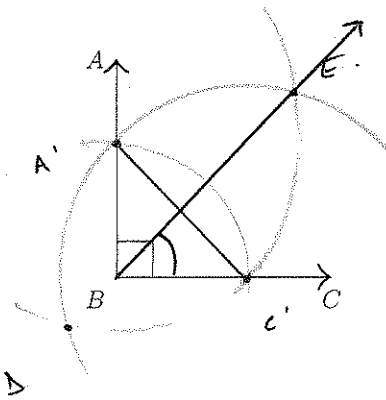
Supplementary angles add to 90° .

True False

A triangle can have two obtuse angles.

True False

3. (10 points) You are given the following 90° angle $\angle ABC$. Use a compass and straightedge to construct a 45° angle. Clearly identify your steps.



1) Draw circle, center B
any radius. Mark A' , C' .

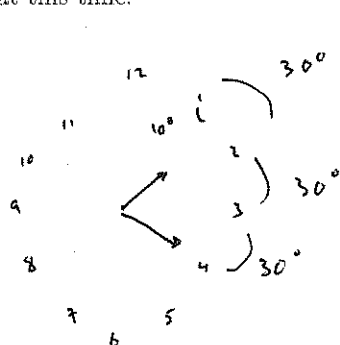
2) Draw segment $\overline{A'C'}$.

3) Circle, center A' radius $A'C'$
 — " — C' — " —
 Mark DE .

4) Ray \overrightarrow{BE} bisects $\overline{A'C'}$.

5). $\angle EBC$ has measure
 $\frac{90}{2} = 45^\circ$ ✓

4. (6 points) Draw a clock face to represent the time at 1:20. Then find the angle between the clock hands at this time.



$$\frac{360^\circ}{12} = 30^\circ \text{ per hour.}$$

$$20 \text{ minutes} = \frac{1}{3} \text{ hour} \rightarrow 10^\circ$$

$$\text{Total: } 30^\circ + 30^\circ + 30^\circ - 10^\circ = \boxed{80^\circ}$$

5. (6 points) A bucket holds 3 L 250 mL of water; 1 L 800 mL is removed from the bucket. How much water remains in the bucket?

Recall : 1 L = 1000 mL

Add 200 mL to get to 2 L

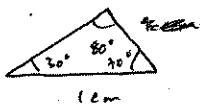
Add 1 L to get to 3 L.

Add 250 mL to get to 3 L 250 mL.

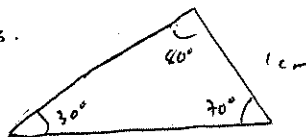
$$\boxed{1 \text{ L } 450 \text{ mL}}$$

6. (6 points) Two triangles both have internal angles 30° , 70° and 80° . They also each have one side with length 1 cm. Are the triangles necessarily congruent? If yes, prove this; if no, use a sketch to provide a counterexample.

No.

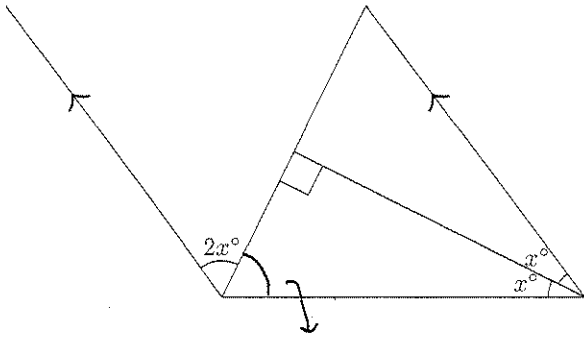


vs.



This works since the sides
(all) have different lengths.

7. (12 points) Write an equation for x and solve it. Justify each step using geometric facts.



$= 90^\circ - x^\circ$ by sum of \angle s in Δ .

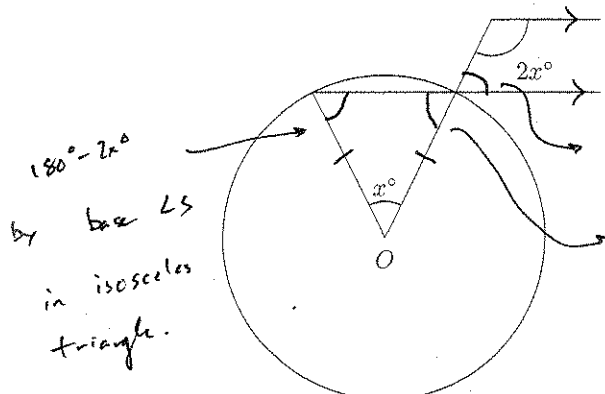
$\therefore [2x + (90 - x)] + [x + x] = 180$

adj. \angle s add
and int \angle s
in transversal.

$\therefore 90 + 3x = 180$

$\therefore \boxed{x = 30}$

8. (12 points) Write an equation for x and solve it. Justify each step using geometric facts. You are given that O is the center of the circle.



$180^\circ - 2x^\circ$
by base \angle s
in isosceles
triangle.
Triangle is
isosceles by
definition of circle.

$180^\circ - 2x^\circ$ by int. \angle s in transversal.

$180^\circ - 2x^\circ$ by vertical \angle s.

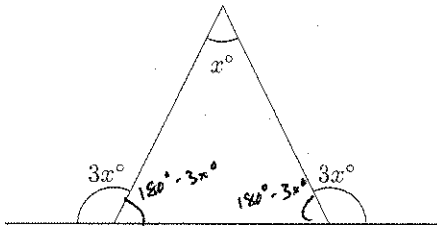
$\therefore x + (180 - 2x) + (180 - 2x) = 180$

sum of
int. \angle s
in Δ

$\therefore 180 - 3x = 0$

$\therefore \boxed{x = 60}$

9. (12 points) Write an equation for x and solve it. Justify each step using geometric facts.



by \angle s on line.

$$x + (180 - 3x) + (180 - 3x) = 180$$

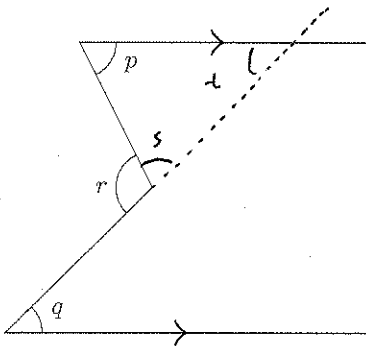
sum of \angle s in Δ

$$\therefore 180 - 5x = 0$$

$$\therefore x = 180/5$$

$$x = 36$$

10. (15 points) Give a careful **proof** of the following statement. Make sure to clearly identify any additional constructions you use, as well as to reference all geometric facts used.



Prove $p + q = r$.

Hint: Start by extending one of the diagonal lines to form a transversal of the pair of parallel lines.

Construction: Extend line & mark angles as shown.

Proof: $s = 180 - r$

angles on line

$$t = q$$

alt. int. \angle s

$$p + s + t = 180$$

sum of int. \angle s in Δ

$$\therefore p + (180 - r) + q = 180$$

$$\therefore p + q - r = 0$$

$$\therefore p + q = r$$

□