tcore 122: Practice Final

You may find the following table helpful if you did not bring a calculator for the final.

x	22.5°	30°	45°	60°	67.5°	135°
$\cos(x)$	$\dfrac{\sqrt{2+\sqrt{2}}}{2}$	$\dfrac{\sqrt{3}}{2}$	$\dfrac{\sqrt{2}}{2}$	$\dfrac{1}{2}$	$\dfrac{\sqrt{2-\sqrt{2}}}{2}$	$-\dfrac{\sqrt{2}}{2}$
$\sin(x)$	$\dfrac{\sqrt{2-\sqrt{2}}}{2}$	$\dfrac{1}{2}$	$\dfrac{\sqrt{2}}{2}$	$\dfrac{\sqrt{3}}{2}$	$\dfrac{\sqrt{2+\sqrt{2}}}{2}$	$\dfrac{\sqrt{2}}{2}$
$\tan(x)$	$\sqrt{\dfrac{2-\sqrt{2}}{2+\sqrt{2}}}$	$\dfrac{1}{\sqrt{3}}$	1	$\sqrt{3}$	$\sqrt{\dfrac{2+\sqrt{2}}{2-\sqrt{2}}}$	-1

1. TRUE/FALSE: If the statement is true, circle T. If the statement is false, circle F *and* explain briefly why the statement is false.

    T   F   Paper was invented in Japan.

    T   F   'Origami' translates to cutting & pasting paper.

    T   F   If line a is perpendicular to line b, and line a is perpendicular to line c, then line b is always perpendicular to line c.

    T   F   The shortest point between two points on a sphere is on the arc of a great circle.

    T   F   A triangle on a sphere may have three right angles.

2. What does the word "Origami" translate to in English?

3. Define science *clearly*. (In a way most modern scientists would agree with! Consider referring to David Deutsch's TED talk.)

4. The two lines l and m are parallel. Find the measure of angle x. Make sure that your *reasoning* is easy to follow. Note, this diagram is not drawn to scale.
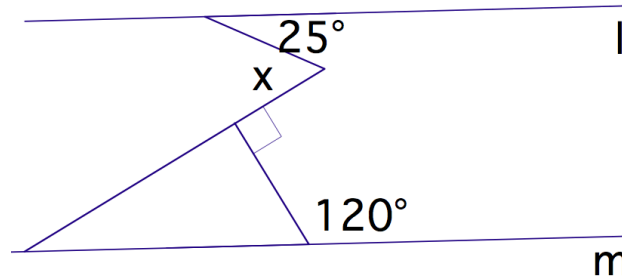
Refer to the diagram on the right when answering the remaining questions on this page. The crease pattern was the result of folding the 'optimum Yoshizawa Split'. Assume the length of the original square is one.

5. Name the intersection of the line $\overline{AB}$ and $\overline{EG}$

6. Name two angles with a vertex at D.

7. Name a pair of lines that are perpendicular (You do *not* need to justify your answer.)

8. Determine the measure of $\angle BEA$ (You do *not* need to justify your answer.)
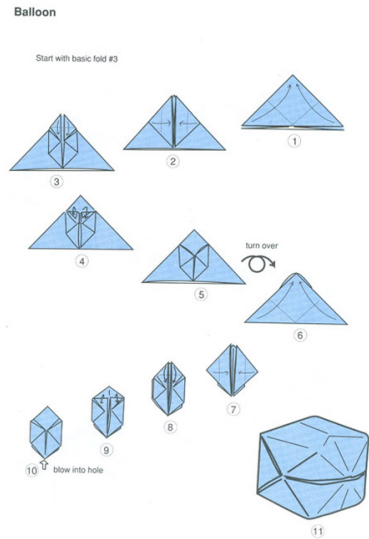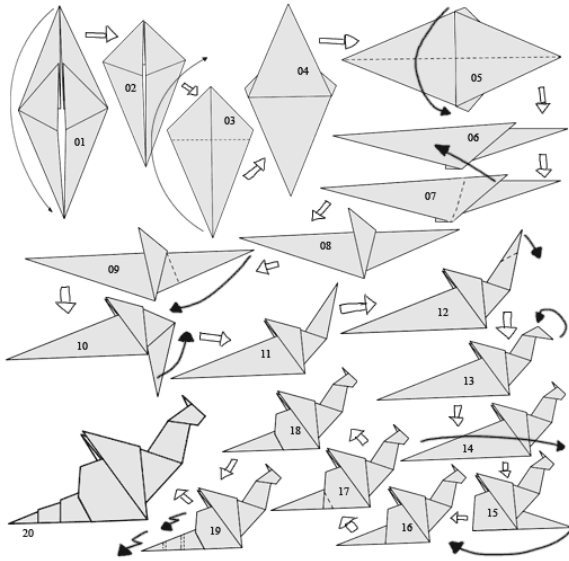
9. Find the length of:
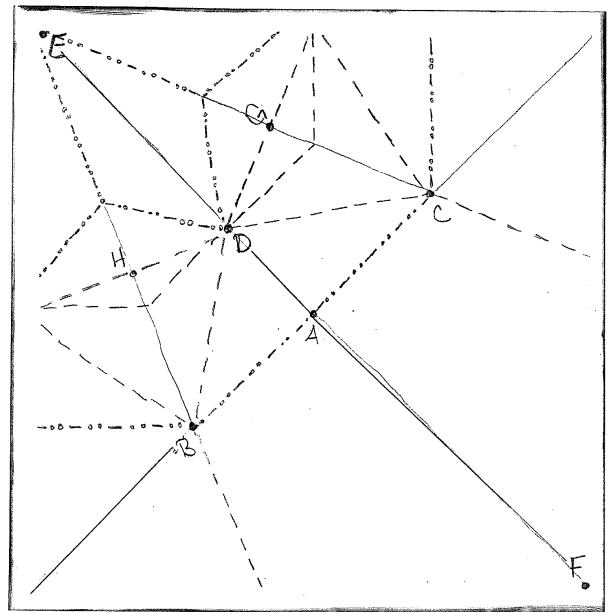
$\overline{EF}$ $\hspace{3cm}$ $\overline{EA}$ $\hspace{3cm}$ $\overline{EB}.$

10. Identify the base used in each of the origami designs shown below.

Balloon
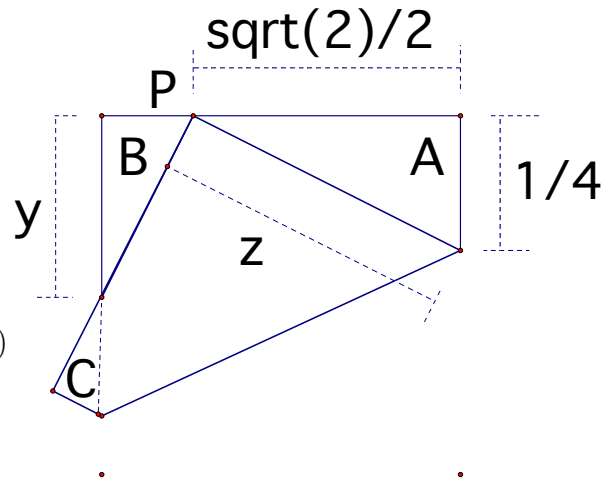
Start with basic fold #3

11. Suppose you folded a patty paper so that the measurements shown in the diagram to the right were satisfied (where the length of the original patty paper has length one).

(If you are more comfortable with decimals you may use the approximation: $\frac{\sqrt{2}}{2} \approx .707$.)
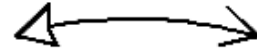

(a) Find the length of z.

(b) Find the length of y.

12. Write the converse to the following conditional statement. Determine the truth value of both conditional statements.

  "If an object is hot, then the object is on fire.

13. Identify what the origami symbols mean below.

14. Write down instructions for folding the bomb base.

15. Define Kirigami and explain how the answer to this is culturally dependent.

16. Describe two of the people interviewed for the "Between the Folds" movie and identify an opinion that they share or that they disagree over.

17. Identify the thesis from Lockhart's *A Mathematician's Lament* and explain the mathematical example he refers to in the first few pages when making this point.

18. Describe four characteristics and guidelines for technical writing as described from Johnson-Sheehan's Technical Communication Today sections assigned.

19. Consider Robert Lang's TED talk. How does Lang defined origami? Briefly explain the mathematical approach Lang takes to creating origami patterns.

20. Write down an argument supporting the position "math is science".

21. Write down an argument against the position "math is science".

22. How did origami spread across the globe and how was Yoshizawa's involved?

23. Describe Gödel's role in the history of mayhematics?

24. Mark the ends of the diameter on a semicircle as A and B as shown on the right.

Consider the triangles show below that have $\overline{AB}$ as one side, and a third vertex C on the semicircle. Notice that both angles $\angle ACB$ measure $90°$!
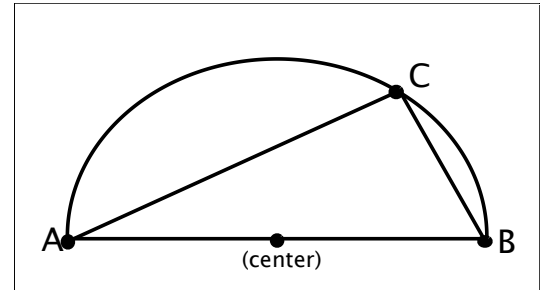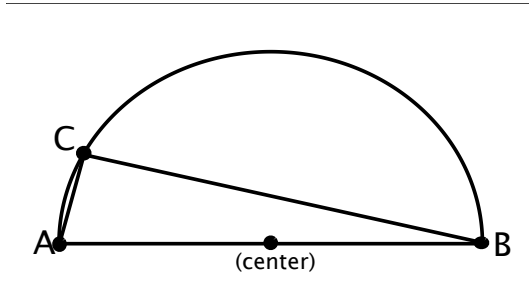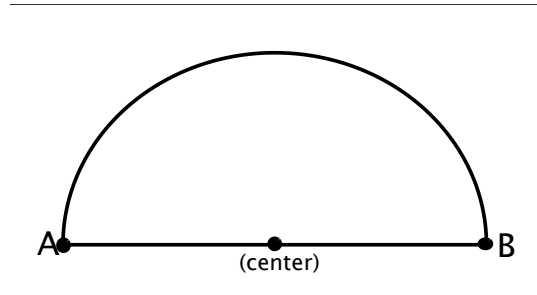
Claim: In general, if a triangle has all of its vertices on a circle and one of its sides is also a diameter, the resulting triangle is a right triangle.
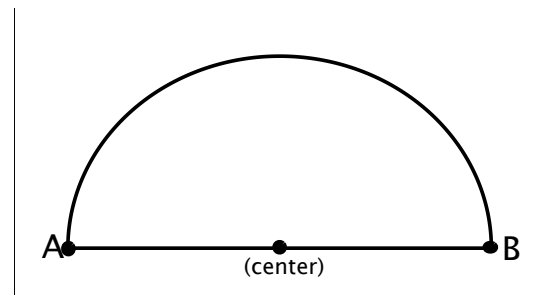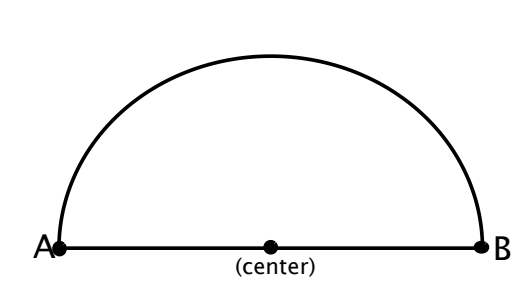
(a) *Explain* a process to use patty paper to verify the above claim.

(b) Find a way to *justify* the above claim without using a preexisting $90°$ corner.