

**MAT 307: Exam 3**  
**Spring – 2023**  
**05/04/2023**  
**85 Minutes**

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**Name:** \_\_\_\_\_

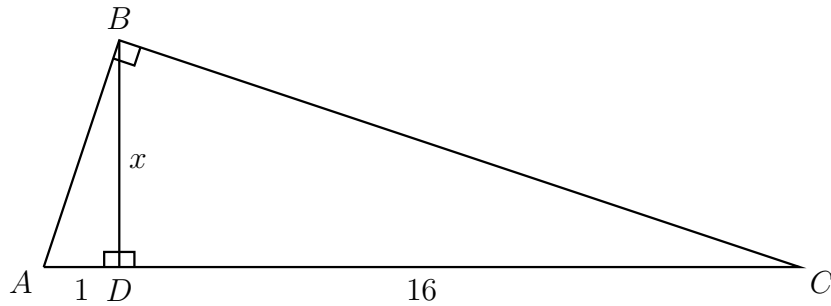
Write your name on the appropriate line on the exam cover sheet. This exam contains 8 pages (including this cover page) and 30 questions. Check that you have every page of the exam. Indicate your answer for each question in the answer column in the table below. You need not indicate your answers for each question both on the cover page and in the subsequent pages. You may show as much or as little work as you would like; however, only the answers on this cover page will be graded. Be sure each answer is legible and in the correct box. Do not write in the 'Points' box on this page.

Question	Answer	Question	Answer	Question	Answer
1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Points	Total
	30

1. Which of the following cannot be the lengths of the sides of a triangle?
  - (a) 1, 7, 8
  - (b) 7, 8, 9
  - (c) 5, 26, 30
  - (d) 19, 180, 181
  
2. If  $\triangle ABC$  is a right triangle whose shortest side has length 12 and whose longest side is 37, what is the length of the other side of the triangle?
  - (a) 12.25
  - (b) 24.5
  - (c) 25
  - (d) 35
  
3. Suppose a triangle has sides with length 85 and 112. What is the smallest possible length of the third side if the side must have a length which is an integer?
  - (a) 27
  - (b) 28
  - (c) 197
  - (d) 198
  
4. Triangle  $\triangle ABC$  is a right triangle with side lengths 20, 21, and 29. We know that the shortest side of  $\triangle DEF$  has length 5 and  $\triangle DEF \sim \triangle ABC$ . What is the area of  $\triangle DEF$ ?
  - (a) 13.1
  - (b) 52.5
  - (c) 70.0
  - (d) 210.0

5. Find  $x$  in the triangle below.



- (a) 1
  - (b) 4
  - (c) 8
  - (d) 10
6. Which of the following geometric constructions is not possible using a straightedge and compass?
- (a) Constructing a perpendicular bisector to a given line segment.
  - (b) Constructing an angle double the measure of a given angle.
  - (c) Constructing the angle bisector of a given angle.
  - (d) Constructing the angle trisector of a given angle.
7. Suppose a regular octagonal cylinder has volume  $165.3 \text{ cm}^3$ . What is the volume of the cylinder after a dilation with scale factor 2.5?
- (a)  $10.58 \text{ cm}^3$
  - (b)  $66.12 \text{ cm}^3$
  - (c)  $413.25 \text{ cm}^3$
  - (d)  $2582.81 \text{ cm}^3$
8. Which of the following properties does not guarantee that two triangles are congruent?
- (a) AAA
  - (b) SSS
  - (c) SAS
  - (d) AAS

9. Which of the following is *not* true.
- (a) The plane can be tiled with *any* triangular tile.
  - (b) The plane can be tiled with *any* quadrilateral tile.
  - (c) The plane can be tiled with *any* pentagonal tile.
  - (d) The plane can be tiled with *some* hexagonal tiles.
10. What is the measure of the largest angle in an isosceles triangle whose smallest angle is  $12^\circ$ ?
- (a)  $12^\circ$
  - (b)  $84^\circ$
  - (c)  $156^\circ$
  - (d)  $168^\circ$
11. Suppose you are given three distinct positive integers  $a$ ,  $b$ , and  $c$ . What is maximum number of distinct triangles with sides having length  $a$ ,  $b$ , and  $c$  that can be constructed?
- (a) 0
  - (b) 1
  - (c) 2
  - (d) 3
12. Suppose you are given three distinct positive integers  $a$ ,  $b$ , and  $c$ . How many distinct triangles with angles having measures  $a$ ,  $b$ , and  $c$  can be constructed?
- (a) 0
  - (b) 1
  - (c) 3
  - (d) Infinitely many
13. How many distinct right triangles are with the hypotenuse having length 13 if the hypotenuse makes angles  $56^\circ$  and  $64^\circ$  with the legs of the triangle?
- (a) 0
  - (b) 1
  - (c) 3
  - (d) Infinitely many

14. Which of the following cannot be used to regularly tile the plane?
- (a) equilateral triangles
  - (b) squares
  - (c) regular pentagons
  - (d) regular hexagons
15. Which of the following statements is *not* true?
- (a) All congruent triangles are similar.
  - (b) All similar triangles are congruent.
  - (c) The image of a triangle under a glide reflection is always congruent to the preimage.
  - (d) The image of a triangle under a dilation is always similar to the preimage.
16. Suppose that  $\triangle ABC$  is a right triangle with sides 33, 56, and 65, and  $\triangle ABC \sim \triangle DEF$ . If the hypotenuse of  $\triangle DEF$  has length 260, find the length of the shortest side of  $\triangle DEF$ .
- (a) 14
  - (b) 16
  - (c) 132
  - (d) 224
17. Suppose that  $\triangle ABC$  is a right triangle and  $\triangle ABC \sim \triangle DEF$ . If  $|\overline{AB}| = |\overline{BC}|$ , which of the following is the measure of the smallest angle in  $\triangle DEF$ .
- (a)  $30^\circ$
  - (b)  $45^\circ$
  - (c)  $50^\circ$
  - (d)  $60^\circ$
18. Suppose that  $\triangle ABC \cong \triangle DEF$ . If  $\triangle ABC$  is isosceles, which of the following is *not* true about  $\triangle DEF$ :
- (a)  $\triangle DEF$  is isosceles.
  - (b)  $\triangle DEF$  is a right triangle.
  - (c)  $\triangle DEF$  has two congruent angles.
  - (d)  $\triangle DEF$  is similar to  $\triangle ABC$ .

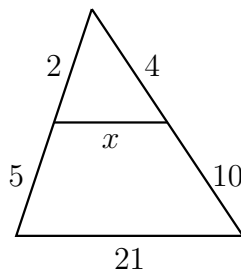
19. The sides of a right triangle with angles  $30^\circ$ ,  $60^\circ$ , and  $90^\circ$  are in the proportion  $1 : \sqrt{3} : 2$ . If the hypotenuse of  $30^\circ$ ,  $60^\circ$ ,  $90^\circ$  triangle has length 10.87, what is the length of the second largest side?

(a) 5.44  
(b) 6.28  
(c) 9.41  
(d) 12.55

20. Which of the following is *not* a rigid transformation?

(a) translation  
(b) reflection  
(c) dilation  
(d) rotation

21. If the two horizontal lines shown below are parallel, find  $x$ .



(a) 6  
(b) 8  
(c) 10  
(d) 12

22. If the image of reflecting a point  $P$  through the line  $x = 2$  is  $(-4, 6)$ , which of the following is  $P$ ?

(a)  $(2, 6)$   
(b)  $(8, 6)$   
(c)  $(-6, 6)$   
(d)  $(6, -4)$

23. Which of the following is the image of the point  $P = (5, -2)$  after a rotation of  $90^\circ$  counterclockwise about the origin?
- (a)  $(-5, -2)$
  - (b)  $(-2, 5)$
  - (c)  $(2, 5)$
  - (d)  $(5, 2)$
24. Suppose that  $a < b$ . If one reflects a point  $P$  through the line  $x = a$  and then reflects the image through the line  $x = b$ , which of the following is an equivalent transformation?
- (a) A translation of  $P$  a distance  $a + b$  to the right.
  - (b) A translation of  $P$  a distance  $b - a$  to the left.
  - (c) A translation of  $P$  a distance  $a + b$  to the left.
  - (d) A translation of  $P$  a distance  $b - a$  to the right.
25. Suppose one reflects a point  $P$  through the line  $x = 2$  and then reflects this image through the line  $y = 3$ . Which of the following is an equivalent transformation?
- (a) A rotation of  $180^\circ$  about the point  $(2, 3)$
  - (b) A translation of 2 to the right and 3 upwards.
  - (c) A rotation of  $180^\circ$  about the origin.
  - (d) A translation of 2 to the left and 3 downwards.
26. Which of the following transformations is a rigid transformation which does *not* preserve orientation?
- (a) dilation
  - (b) translation
  - (c) rotation
  - (d) reflection

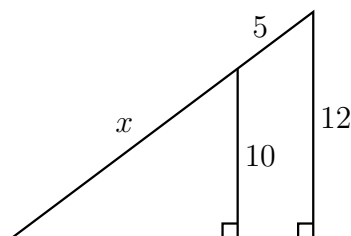
27. A regular decagon has sides with length 17.9 m. After a dilation with scale factor 0.6, what is the perimeter of the resulting decagon?

- (a) 10.74 m
- (b) 23.9 m
- (c) 107.4 m
- (d) 185 m

28. Let  $T$  be the translation of a point  $(x, y)$  given by  $(x - 3, y + 2)$ . Let  $T'$  be the translation of a point  $(x, y)$  given by  $(x + 6, y - 3)$ . Let  $P$  be the image of the point  $(x, y)$  after applying the transformation  $T$  and then  $T'$ . Which of the following is the translation that take the point  $P$  to the point  $(x, y)$ ?

- (a)  $(x + 3, y - 1)$
- (b)  $(x + 9, y - 5)$
- (c)  $(y - 3, x + 1)$
- (d)  $(x - 3, y + 1)$

29. Find  $x$  in the triangle below.



- (a) 3
- (b) 6
- (c) 25
- (d) 27

30. Which of the following regular  $n$ -gon is *not* constructible with a compass and straight-edge?

- (a) 3-gon
- (b) 4-gon
- (c) 5-gon
- (d) 9-gon