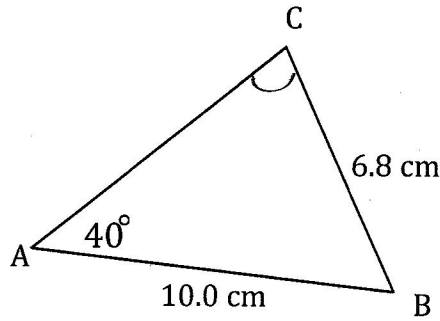


MATH 2201  
Sample Midterm Exam

Part I: Selected Response  
Value: 30 Points

Instructions: Circle the correct answer for each question on the multiple choice answer sheet.

1. What is the measure of  $\angle C$ ?



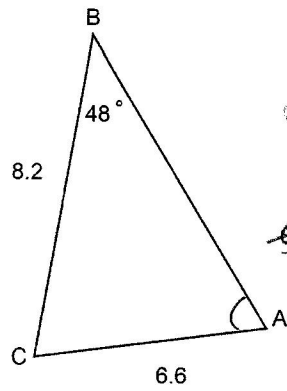
- (A) 20°
- (B) 26°
- (C) 69°
- (D) 71°

~~$\frac{\sin C}{10.0} = \frac{\sin 40^\circ}{6.8}$~~

$\frac{6.8 \sin C}{6.8} = \frac{10.0 \sin 40.0^\circ}{6.8}$   
 $\sin C = 0.9453$   
 $C = \sin^{-1}(0.9453)$   
 $C = 71^\circ$

2. What is the measure of  $\angle A$ ?

- A) 37°
- B) 42°
- C) 51°
- (D) 67°

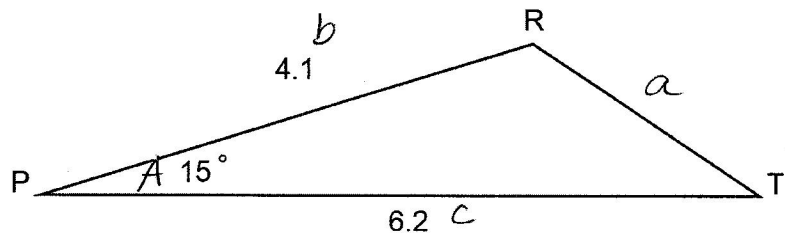


~~$\frac{\sin A}{8.2} = \frac{\sin 48^\circ}{6.6}$~~

$\frac{6.6 \sin A}{6.6} = \frac{8.2 \sin 48^\circ}{6.6}$   
 $\sin A = 0.9233$   
 $A = \sin^{-1}(0.9233)$   
 $A = 67^\circ$

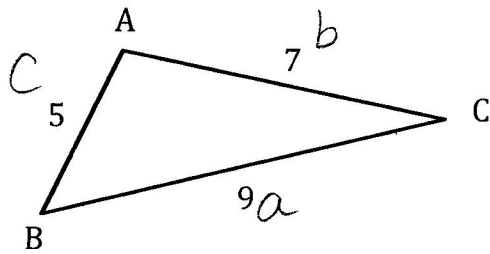
3. Find the length of  $\overline{RT}$ .

- A) 1.6
- (B) 2.5
- C) 4.7
- D) 7.4



$a^2 = b^2 + c^2 - 2bc \cos A$   
 $a^2 = 4.1^2 + 6.2^2 - 2(6.2 \times 4.1) \cos 15^\circ$   
 $a^2 = 6.14$   
 $a = \sqrt{6.14} = 2.5$

4. Which equals the measure of  $\angle A$ ?



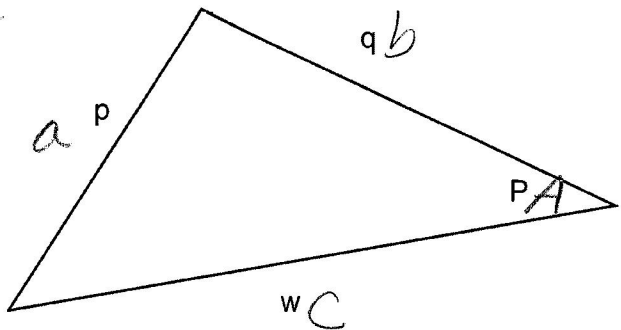
$$\cos A = \frac{b^2 + c^2 - a^2}{2cb}$$

$$= \frac{7^2 + 5^2 - 9^2}{2(5)(7)}$$

- (A)  $\cos^{-1} \left( \frac{5^2 + 9^2 - 7^2}{2(5)(9)} \right)$
- (B)  $\cos^{-1} \left( \frac{7^2 + 5^2 - 9^2}{2(7)(5)} \right)$
- (C)  $\cos^{-1} \left( \frac{9^2 + 5^2 - 7^2}{2(9)(5)} \right)$
- (D)  $\cos^{-1} \left( \frac{9^2 + 7^2 - 5^2}{2(9)(7)} \right)$

5. Which is a proper application of the cosine law for  $\triangle PWQ$ ?

- (A)  $p^2 = q^2 + w^2 - 2qw \cos P$  ✓
- (B)  $q^2 = p^2 + w^2 - 2qw \cos Q$
- (C)  $\cos W = \frac{p^2 + w^2 - q^2}{2pw}$
- (D)  $\cos Q = \frac{p^2 + w^2 - q^2}{2wq}$

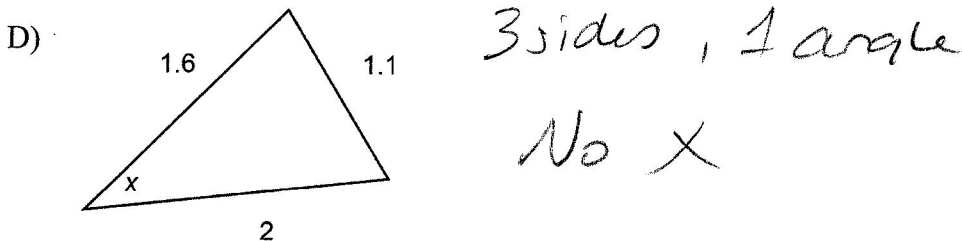
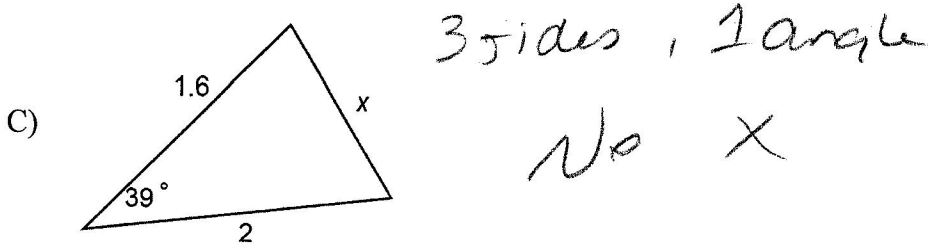
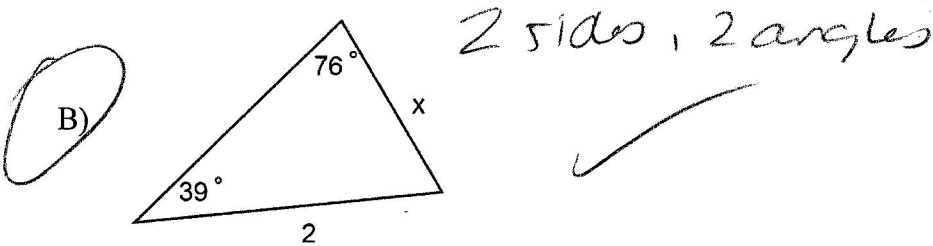
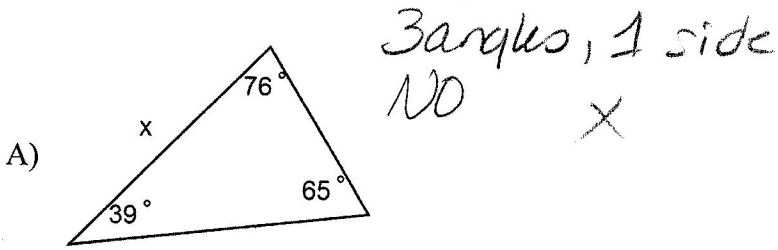


Check A solve for p

$$a^2 = b^2 + c^2 - 2cb \cos A$$

$$p^2 = q^2 + w^2 - 2wq \cos P$$

6. Which triangle can you use the Sine Law to find  $x$ ?



7. Simplify completely:

- (A)  $11\sqrt{7}$
- (B)  $17\sqrt{7}$
- (C)  $11\sqrt{14}$
- (D)  $8\sqrt{35}$

$$\begin{aligned}
 &5\sqrt{7} + 3\sqrt{28} \\
 &= 5\sqrt{7} + 3(2\sqrt{7}) \\
 &= 5\sqrt{7} + 6\sqrt{7} \\
 &= 11\sqrt{7}
 \end{aligned}$$

$$\begin{aligned}
 \sqrt{28} &= \sqrt{4} \sqrt{7} \\
 &= 2\sqrt{7}
 \end{aligned}$$

8. Which is expressed as an entire radical?

A)  $2^3\sqrt{8}$

B)  $3\sqrt{4}$

C)  $2\sqrt{5}$

D)  $\sqrt{10}$

No number in front of  $\sqrt{\quad}$

9. Which expression is equivalent to  $\sqrt{32}$ ?

A)  $4\sqrt{2}$

B)  $16\sqrt{2}$

C)  $2\sqrt{4}$

D)  $8\sqrt{4}$

$$\begin{aligned}\sqrt{32} &= \sqrt{16} \sqrt{2} \\ &= 4\sqrt{2}\end{aligned}$$

10. Simplify:

$$2\sqrt{3}(\sqrt{6} + 1) = 2\sqrt{18} + 2\sqrt{3}$$

A)  $6\sqrt{2} + 1$

B)  $6\sqrt{2} + 2\sqrt{3}$

C)  $18\sqrt{2} + 1$

D)  $18\sqrt{2} + 2\sqrt{3}$

$$= 2(3\sqrt{2}) + 2\sqrt{3}$$

$$= 6\sqrt{2} + 2\sqrt{3}$$

$$\begin{aligned}\sqrt{18} &= \sqrt{9} \sqrt{2} \\ &= 3\sqrt{2}\end{aligned}$$

11. Simplify:

A)  $-\sqrt{25}$

B)  $-\sqrt{5}$

C)  $-\sqrt{3} - \sqrt{2}$

D)  $-\sqrt{3} - 5\sqrt{2}$

$$\begin{aligned}\sqrt{12} - \sqrt{18} - \sqrt{27} + \sqrt{8} \\ &= 2\sqrt{3} - 3\sqrt{2} - 3\sqrt{3} + 2\sqrt{2}\end{aligned}$$

$$= 2\sqrt{3} - 3\sqrt{3} - 3\sqrt{2} + 2\sqrt{2}$$

$$= -\sqrt{3} - \sqrt{2}$$

$$\begin{aligned}\sqrt{12} &= \sqrt{4} \sqrt{3} \\ &= 2\sqrt{3}\end{aligned}$$

$$\begin{aligned}\sqrt{18} &= \sqrt{9} \sqrt{2} \\ &= 3\sqrt{2}\end{aligned}$$

$$\begin{aligned}27 &= \sqrt{9} \sqrt{3} \\ &= 3\sqrt{3}\end{aligned}$$

$$\begin{aligned}\sqrt{8} &= \sqrt{4} \sqrt{2} \\ &= 2\sqrt{2}\end{aligned}$$

12. Simplify completely:

$$\frac{5\sqrt{32}}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{96}}{2\sqrt{9}} = \frac{5(4\sqrt{6})}{2(3)}$$

(A)  $\frac{10\sqrt{6}}{3}$

(B)  $\frac{40\sqrt{6}}{3}$

(C)  $\frac{5\sqrt{96}}{6}$

(D)  $\frac{10\sqrt{96}}{12}$

$$= \frac{20\sqrt{6}}{6}$$

Reduce

$$= \frac{10\sqrt{6}}{3}$$

$$\sqrt{96} = \sqrt{16} \sqrt{6} = 4\sqrt{6}$$

13. Simplify completely:  $\sqrt[3]{-8x^{17}}$

(A)  $-2x^2 \sqrt[3]{x^5}$

(B)  $-2x^5 \sqrt[3]{x^2}$

(C)  $2x \sqrt[3]{-2x^8}$

(D)  $2x^8 \sqrt[3]{-2x}$

$$\begin{aligned} \sqrt[3]{x^{17}} &= \sqrt[3]{x^3} \cdot \sqrt[3]{x^3} \cdot \sqrt[3]{x^3} \cdot \sqrt[3]{x^3} \cdot \sqrt[3]{x^3} \cdot \sqrt[3]{x^2} \\ &= x \cdot x \cdot x \cdot x \cdot x \cdot \sqrt[3]{x^2} \\ &= x^5 \cdot \sqrt[3]{x^2} \end{aligned}$$

$$\begin{aligned} \sqrt[3]{-8x^{17}} &= \sqrt[3]{-8} \cdot \sqrt[3]{x^{17}} \\ &= -2x^5 \cdot \sqrt[3]{x^2} \end{aligned}$$

14. Write  $3x^3 \sqrt{5x}$  as an entire radical.

(A)  $\sqrt{15x^4}$

(B)  $\sqrt{15x^7}$

(C)  $\sqrt{45x^4}$

(D)  $\sqrt{45x^7}$

$$\begin{aligned} &\sqrt{(3x^3)^2} \cdot \sqrt{5x} \\ &= \sqrt{9x^6} \cdot \sqrt{5x} = \sqrt{45x^7} \end{aligned}$$

15. Simplify:

$$\frac{\sqrt{5x}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{10x}}{\sqrt{4}} = \frac{\sqrt{10x}}{2}$$

A)  $\frac{\sqrt{5x}}{2}$

(B)  $\frac{\sqrt{10x}}{2}$

C)  $\frac{\sqrt{10x}}{4}$

D)  $\frac{5\sqrt{x}}{2}$

16. What are the restrictions on the variable for  $\sqrt{x+2}$  ?

$$x+2 \geq 0$$

$$x \geq -2$$

- (A)  $x \geq -2$
- (B)  $x > -2$
- (C)  $x \geq 2$
- (D)  $x > 2$

17. State the restrictions on  $x$  for the radical equation:  $\sqrt{x-4} = 2$

$$x-4 \geq 0$$

$$x \geq 4$$

- A)  $x \geq -4, x \in R$
- B)  $x \leq -4, x \in R$
- (C)  $x \geq 4, x \in R$
- D)  $x \leq 4, x \in R$

18. Simplify:  $\frac{\sqrt{80x^5}}{\sqrt{5x}} = \sqrt{16x^4} = \sqrt{16} \cdot \sqrt{x^4} = 4x^2$

- A)  $\sqrt{75x^4}$
- B)  $\sqrt{16x^5}$
- (C)  $4x^2$
- D)  $16x^4$
- E)

19. A student was asked to simplify  $\frac{x\sqrt{18x^3}}{3}$  but did not complete a correct solution. Which step contains her first error?

Solution:

Step 1:  $\frac{x\sqrt{9 \cdot 2 \cdot x^2 \cdot x}}{3}$  OK

Step 2:  $\frac{x\sqrt{9x^3} \sqrt{2x}}{3}$

Step 3:  $\frac{9x^3 \sqrt{2x}}{3}$

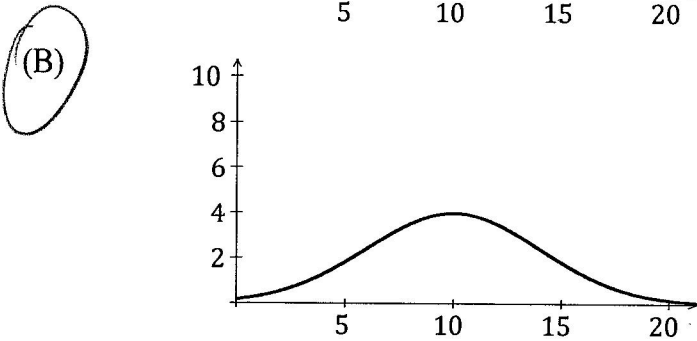
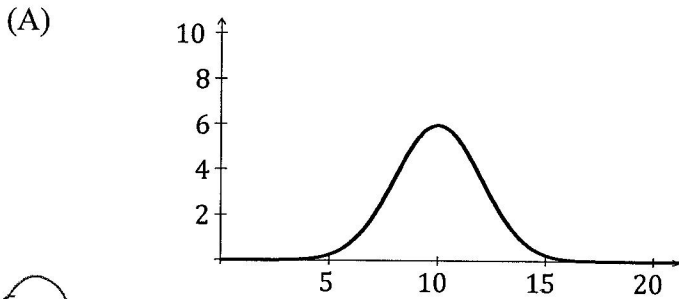
Step 4:  $3x^3 \sqrt{2x}$

- (A) 1
- (B) 2
- (C) 3
- (D) 4

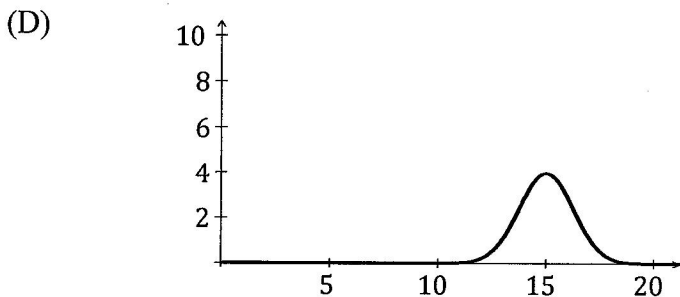
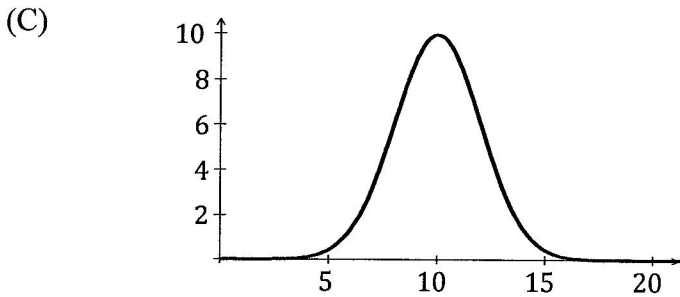
20. A set of data is normally distributed. What percent of the data is within two standard deviations of the mean?

- (A) 47.5
- (B) 68
- (C) 95
- (D) 99.7

21. Which represents data with the largest standard deviation?



*spread out the most*

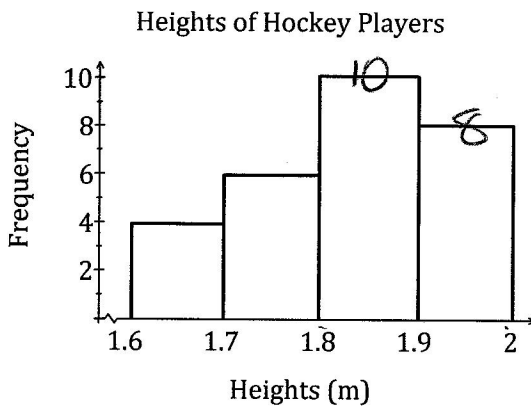


22. A study of income in a large city states the mean family income is \$29 500. The study states the results are accurate 9 times out of 10. What is the confidence level in this situation?

- (A) 90%  
 (B) 95%  
 (C) 99%  
 (D) 100%

$$\frac{9}{10} = 90\%$$

23. The histogram shown represents the heights of hockey players on a professional hockey team. How many players have a height between 1.8 m and 2.0 m?



$$10 + 8 = 18$$

- (A) 10  
 (B) 18  
 (C) 24  
 (D) 28

24. The number of goals by all hockey players in the NHL is normally distributed. The mean number of goals is 18 with a standard deviation of 4 goals. In what goal range would

68% of the players score?

A) 10 to 22

B) 10 to 26

(C) 14 to 22

D) 14 to 26

$$18 - 4 = 14$$

$$18 + 4 = 22$$

14 to 22

25. A random survey of 100 teens reported that 28% of those surveyed exercise at least three times per week. The results are considered accurate within  $\pm 4$  percent, 19 times out of 20. If the sample size is increased, which statement is most accurate? *results would become*

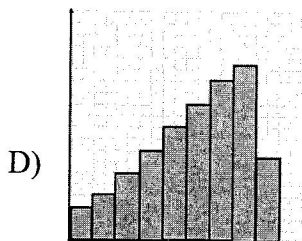
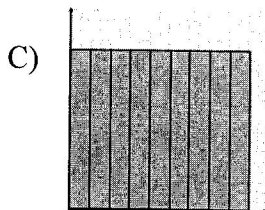
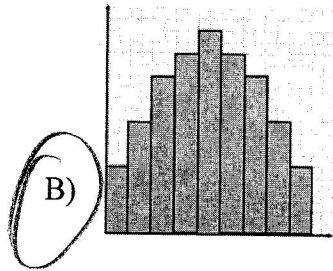
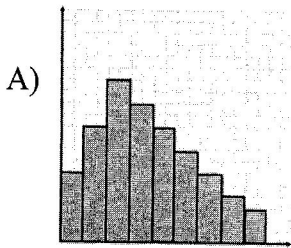
- (A) The margin of error will decrease  
 (B) The margin of error will increase  
 (C) The mean will decrease  
 (D) The mean will increase

*more accurate*

*\(\therefore \pm 4\) would get smaller  
 ie margin of error would decrease*



26. Which graph represents data which approximates the normal distribution?



*Closest to a bell-shaped curve*

27. What is the vertex of  $y = 2x^2 + 8x - 5$ ?

- (A)  $(-2, -29)$
- (B)  $(-2, -13)$
- (C)  $(2, 15)$
- (D)  $(2, 19)$

$$x = \frac{-b}{2a} = \frac{-8}{2(2)} = \frac{-8}{4} = -2$$

$$y = 2(-2)^2 + 8(-2) - 5$$

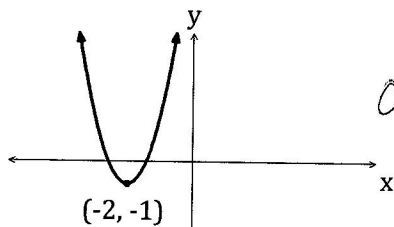
$$y = -13$$

$$(-2, -13)$$

*opens down*

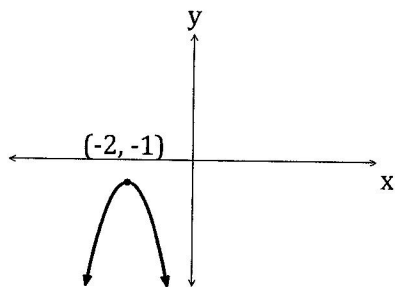
28. The function  $y = -3x^2 - 12x - 13$  has axis of symmetry  $x = -2$ . Which represents the function?

~~(A)~~

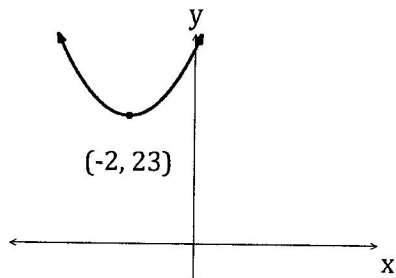


*opens up*

(B)

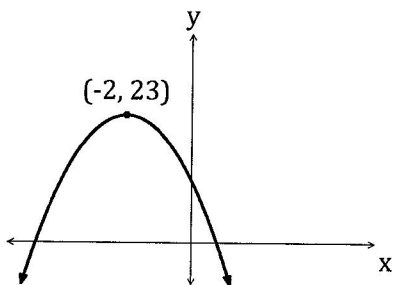


~~(C)~~



*opens up*

(D)



*Vertex  $x = -2$*

$$y = -3x^2 - 12x - 13$$

$$y = -3(-2)^2 - 12(-2) - 13$$

$$y = -1$$

*$(-2, -1)$*

29. What is the y-intercept of  $y = 3x^2 + 4x + 5$ ?

A) 2

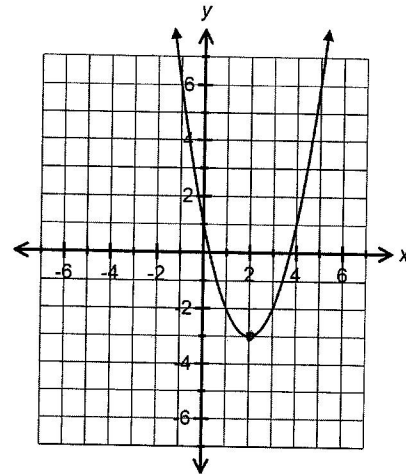
B) 3

C) 4

(D) 5

30. What is the vertex of the graph?

- A) (-3, 2)
- B) (-2, 3)
- C) (2, -3)
- D) (3, -2)

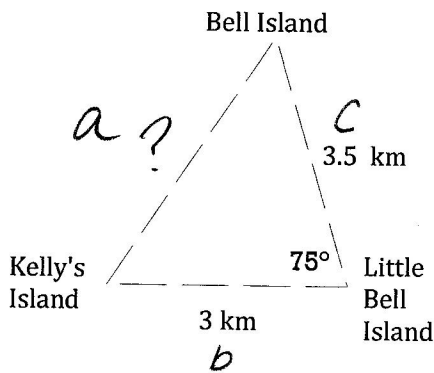


(2, -3)

**Part II: Constructed Response**  
**Value: 45 Points**

**Instructions:** Answer ALL questions in the space provided. ALL workings must be shown to obtain full marks.

1. A boat travels from Bell Island to Kelly's Island to Little Bell Island, and returns directly back to Bell Island. What is the total distance travelled? [Value: 5 Points]



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = 3^2 + 3.5^2 - 2(3.5)(3) \cos 75^\circ$$

$$a^2 = 26.6852$$

$$a = 5.2 \text{ km}$$

$$\text{Total Distance} = 5.2 \text{ km} + 3.5 \text{ km} + 3 \text{ km}$$

$$= 11.7 \text{ km}$$

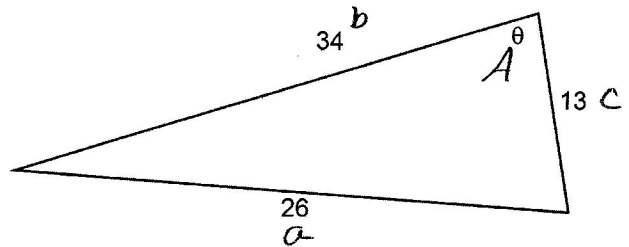
2. Find the value of angle  $\theta$  to the nearest degree. [Value: 4 Points]

$$\cos A = \frac{b^2 + c^2 - a^2}{2cb}$$

$$\cos \theta = \frac{34^2 + 13^2 - 26^2}{2(13)(34)}$$

$$\cos \theta = \frac{649}{884}$$

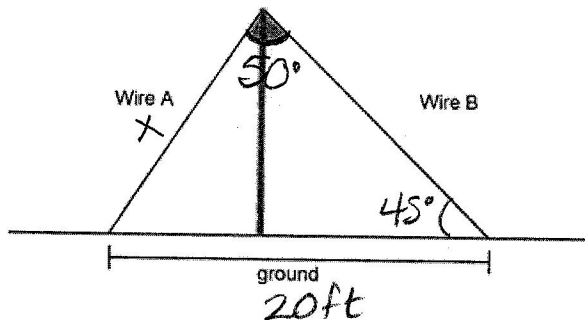
$$\cos \theta = 0.7342$$



$$\theta = \cos^{-1}(0.7342)$$

$$\theta = 43^\circ$$

3. A telephone pole is supported by two wires on opposite sides. At the top of the pole, the wires meet to form an angle of  $50^\circ$ . On the ground, the ends of the wires are 20 ft apart. Wire B makes a  $45^\circ$  angle with the ground. What is the length of wire A? [Value: 4 Points]



~~$$\frac{\sin 45^\circ}{x} = \frac{\sin 50^\circ}{20}$$~~

$$\frac{20 \sin 45^\circ}{\sin 50^\circ} = \frac{x \sin 50^\circ}{\sin 50^\circ}$$

$$x = 18.5 \text{ ft}$$

or  
19 ft

4. Simplify completely:  $5\sqrt{6}(\sqrt{3} + 3\sqrt{12} - \sqrt{2})$  [Value: 4 Points]

$$\begin{aligned} &= 5\sqrt{18} + 15\sqrt{72} - 5\sqrt{12} \\ &= 5(3\sqrt{2}) + 15(6\sqrt{2}) - 5(2\sqrt{3}) \\ &= 15\sqrt{2} + 90\sqrt{2} - 10\sqrt{3} \\ &= 105\sqrt{2} - 10\sqrt{3} \end{aligned}$$

$$\begin{aligned} \sqrt{18} &= \sqrt{9}\sqrt{2} \\ &= 3\sqrt{2} \end{aligned}$$

$$\begin{aligned} \sqrt{72} &= \sqrt{36}\sqrt{2} \\ &= 6\sqrt{2} \end{aligned}$$

$$\begin{aligned} \sqrt{12} &= \sqrt{4}\sqrt{3} \\ &= 2\sqrt{3} \end{aligned}$$

5. Simplify:  $(\sqrt{3} + \sqrt{2})^2$  [Value: 4 Points]

$$\begin{aligned} &= (\sqrt{3} + \sqrt{2})(\sqrt{3} + \sqrt{2}) \\ &= \sqrt{9} + \sqrt{6} + \sqrt{6} + \sqrt{4} \\ &= 3 + 2\sqrt{6} + 2 \\ &= 5 + 2\sqrt{6} \end{aligned}$$

6. State the restrictions on  $x$ , solve the equation, and then check for extraneous roots.  
[Value: 5 Points]

Restrictions

$$3x+1 \geq 0$$

$$\frac{3x}{3} \geq \frac{-1}{3}$$

$$x \geq -\frac{1}{3}$$

Solve

$$\sqrt{3x+1} - 3 = -4$$

$$\sqrt{3x+1} = -4+3$$

$$(\sqrt{3x+1})^2 = (-1)^2$$

$$3x+1 = 1$$

$$3x = 1-1$$

$$\frac{3x}{3} = \frac{0}{3}$$

$$x = 0$$

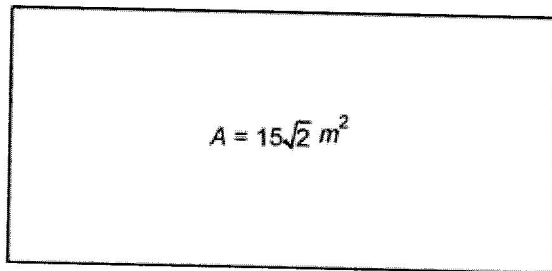
Check for Ext. Roots

LHS	RHS
$\sqrt{3x+1} - 3$	$-4$
$\sqrt{3(0)+1} - 3$	
$\sqrt{1} - 3$	
$1 - 3$	
$-2$	

$$\text{LHS} \neq \text{RHS} \therefore$$

$x=0$  is an ext. root

7. A rectangular dog kennel has an area of  $15\sqrt{2} \text{ m}^2$ , and a width of  $\sqrt{6} \text{ m}$ . Determine the perimeter of the dog kennel in simplest form, using exact values. [Value: 3 Points]



$$w = \sqrt{6} \text{ m}$$

$$\begin{aligned} \text{Perimeter} &= 2L + 2W \\ &= 2(5\sqrt{3}) + 2\sqrt{6} \\ &= \boxed{10\sqrt{3} + 2\sqrt{6}} \end{aligned}$$

$$\begin{aligned} A &= L \times w \\ \frac{15\sqrt{2}}{\sqrt{6}} &= \frac{L(\sqrt{6})}{\sqrt{6}} \end{aligned}$$

$$L = \frac{15\sqrt{2}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}} = \frac{15\sqrt{12}}{\sqrt{36}} = \frac{15\sqrt{4}\sqrt{3}}{6} = \frac{30\sqrt{3}}{6} = 5\sqrt{3}$$

8. Jason scored 82% on a test where the class average was 74% and the standard deviation was 10.6%. What percentage of the class scored better than Jason? [Value: 4 Points]

$$X = 82$$

$$\mu = 74$$

$$\sigma = 10.6$$

$$Z = ?$$

$$Z = \frac{X - \mu}{\sigma} = \frac{82 - 74}{10.6}$$

$$Z = 0.75$$

→ look up in Z-score table

$$0.7734 \text{ or } 77.34\%$$

∴ 77.34% scored LOWER than Jason

Find the % of students that scored HIGHER than Jason...

$$100\% - 77.34\%$$

$$= \boxed{22.66\%}$$

9. A factory produces automotive brake pads with a mean mass of 174 g and a standard deviation of 0.7 g. Quality control expects that the mass of the pads will lie within the acceptable range of 173.9 g and 174.1 g. What is the confidence interval and margin of error this factory uses for its quality control tests? [Value: 4 Points]

margin of error

$$174.1 - 173.9 = 0.2$$

$$\frac{0.2}{2} = 0.1$$

$$\therefore \pm 0.1$$

$$174.1 - 174 = 0.1$$

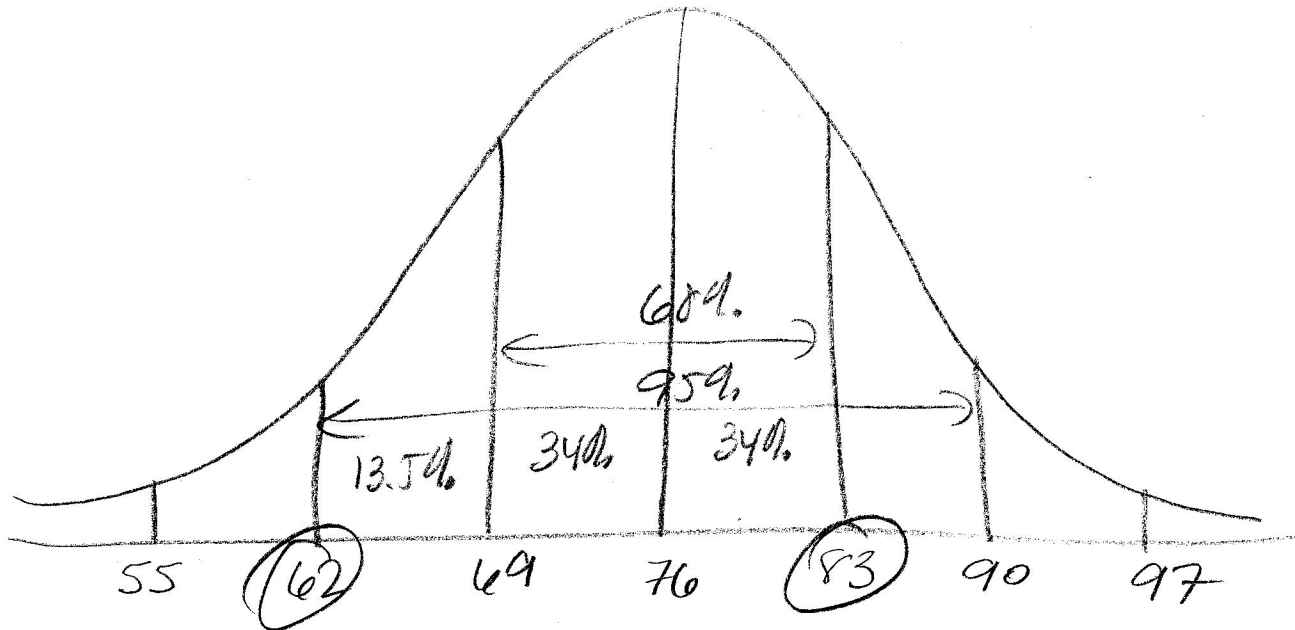
$$\text{or } 174 - 173.9 = 0.1$$

$$\therefore \pm 0.1$$

Confidence interval

$$173.9 \text{ g to } 174.1 \text{ g}$$

10. The results of a math unit test are normally distributed with a mean score of 76 and a standard deviation of 7.  
A) Draw and label the normal curve to represent this data. [Value: 2 Points]



- B) What percent of the student scored between 62 and 83? [Value: 2 Points]

$$13.5\% + 34\% + 34\% = 81.5\%$$



11. The mean life of Brand A batteries is 160 hours with a standard deviation of 20 hours.

A) Determine the z-score of a battery that lasted 170 hours. [Value: 2 Points]

$$\mu = 160$$

$$\sigma = 20$$

$$X = 170$$

$$Z = ?$$

$$Z = \frac{X - \mu}{\sigma}$$

$$= \frac{170 - 160}{20}$$

$$= 0.5$$

B) Using z-scores, what percent of the batteries will last less than 170 hours? [Value: 2 Points]

Z-score tables

$$\rightarrow 0.6915 \text{ or } 69.15\%$$

$\therefore$  69.15% of batteries last less than 170 hours.