

**Mathematics 2201**  
**Common Mathematics Assessment**

**Sample 2013**

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

Mathematics \_\_\_\_\_

Teacher: \_\_\_\_\_

*Answer Key*

28 Selected Response

28 marks

13 Constructed Response

42 marks

**FINAL**  
**TIME: 2 HOURS**

                      
**70 Marks**

**NOTE**

Diagrams are not necessarily drawn to scale.

**FORMULAE**

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	$a^2 = b^2 + c^2 - 2bc \cos A$	$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$
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$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$	$z = \frac{x - \mu}{\sigma}$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
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**Selected Response:** Choose the appropriate response on the answer sheet or SCANTRON.

1. Lisa draws four parallelograms and measures all sides. She writes the statement "*The opposite sides of a parallelogram are equal*" in her notebook. Which term best describes her statement?

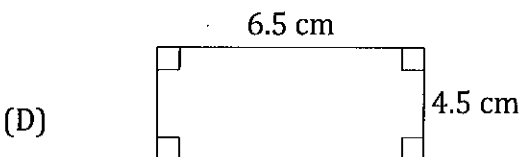
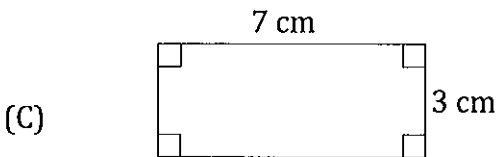
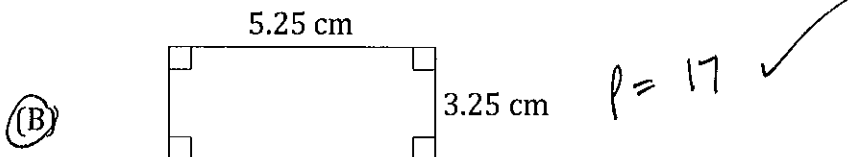
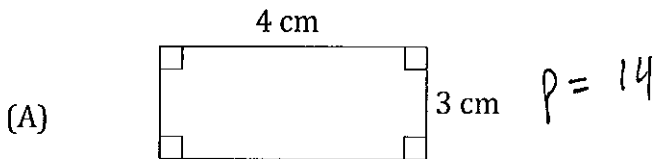
- (A) conjecture
- (B) counterexample
- (C) deductive reasoning
- (D) inductive reasoning

2. What is the missing seventh term in the given sequence?  $\{1, 1, 2, 3, 5, 8, \underline{\quad}, 21\}$

- (A) 11
- (B) 12
- (C) 13
- (D) 14

$5 + 8 = 13$

3. Which figure is a counterexample to the statement below?  
"*The perimeter of a rectangle is never an odd number.*"



4. If  $\angle 1 = \angle 2$  and  $\angle 1 = \angle 3$ , which property proves that  $\angle 2 = \angle 3$ ?

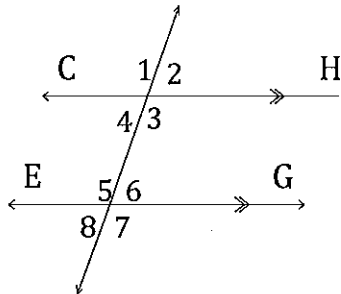
- (A) commutative
- (B) supplementary angles
- (C) transitive
- (D) vertically opposite angles

5. What is the sum of the interior angles of a convex polygon with 14 sides?

- (A)  $2160^\circ$
  - (B)  $2340^\circ$
  - (C)  $2520^\circ$
  - (D)  $2880^\circ$
- $S = 180(14 - 2)$   
 $= 2160^\circ$

6. An incorrect solution is provided to the question below. In which step did the **first** error occur?

Question: Given  $CH \parallel EG$  and  $\angle 1 = 120^\circ$ , what is the measure of  $\angle 7$ ?

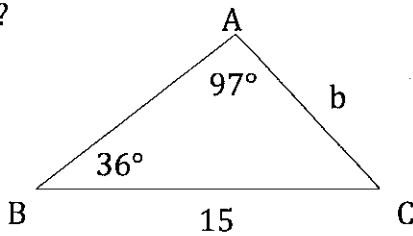


Solution: *Step 1:*  $\angle 1 = \angle 3$  ✓  
*Step 2:*  $\angle 3 = \angle 6$  ✗  
*Step 3:*  $\angle 7 = 180^\circ - \angle 6$   
*Step 4:*  $\angle 7 = 180^\circ - 120^\circ = 60^\circ$

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

7. What is the length of side  $b$ ?

- (A) 8.9
- (B) 11.1
- (C) 18.7
- (D) 25.3

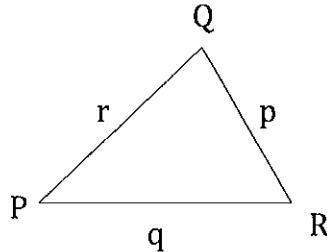


$$\frac{b \cdot \sin 36}{\sin 97} = \frac{15 \cdot \sin 36}{\sin 97}$$

$$b = 8.88$$

8. Which expression is equal to  $\sin Q$ ?

- (A)  $\frac{q}{r \sin R}$
- (B)  $\frac{r}{q \sin R}$
- (C)  $\frac{q \sin R}{r}$
- (D)  $\frac{r \sin R}{q}$



$$\frac{\sin Q \cdot q}{q} = \frac{\sin R \cdot r}{r}$$

9. Simplify completely:

- (A)  $5\sqrt{30}$
- (B)  $17\sqrt{10}$
- (C)  $19\sqrt{30}$
- (D)  $41\sqrt{10}$

$$12\sqrt{40} - 7\sqrt{10}$$

$$= 12 \sqrt{4} \sqrt{10}$$

$$= 24\sqrt{10} - 7\sqrt{10}$$

$$= 17\sqrt{10}$$

10. Simplify completely:

- (A)  $\frac{5\sqrt{10}}{4}$
- (B)  $\frac{15\sqrt{10}}{4}$
- (C)  $\frac{5\sqrt{90}}{12}$
- (D)  $\frac{10\sqrt{90}}{24}$

$$\frac{5\sqrt{15}}{2\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{5\sqrt{90}}{2 \cdot 6}$$

$$\frac{5\sqrt{90}}{12}$$

$$\frac{5 \cdot 3\sqrt{10}}{12 \cdot 3} = \frac{5\sqrt{10}}{4}$$

11. Simplify completely:

$\sqrt{27x^2}$  pairs of 2  
 $8 \div 2 = 1$  no remainder

- (A)  $3x\sqrt{3}$
- (B)  $3x^2\sqrt{3}$
- (C)  $9x\sqrt{3}$
- (D)  $9x^2\sqrt{3}$

$\times \sqrt{9} \sqrt{3}$   
 $3 \times \sqrt{3}$

12. Write  $2y\sqrt[3]{3y}$  as an entire radical.

- (A)  $\sqrt[3]{12y^3}$
- (B)  $\sqrt[3]{24y^2}$
- (C)  $\sqrt[3]{24y^4}$
- (D)  $\sqrt[3]{54y^4}$

$2^3 = 8$   
 $y^3 = y^3$

$8y^3 \cdot 3y$   
 $\sqrt[3]{24y^4}$

13. Brad was asked to simplify  $2\sqrt[3]{64x^5}$  but did not complete a correct solution. Which step contains his **first** error?

Solution:  
Step 1:  $2 \cdot \sqrt[3]{64} \cdot \sqrt[3]{x^5}$   
Step 2:  $2 \cdot 8 \cdot \sqrt[3]{x^3} \cdot \sqrt[3]{x^2}$   
Step 3:  $2 \cdot 8 \cdot x \cdot \sqrt[3]{x^2}$   
Step 4:  $(18x)\sqrt[3]{x^2}$

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

14. What are the restrictions on the variable for  $\frac{1}{\sqrt{x-1}}$ ?  $\leftarrow$  root can't be neg.  
denom can't be zero

- (A)  $x \leq 1$
- (B)  $x \geq 1$
- (C)  $x < 1$
- (D)  $x > 1$

$x - 1 > 0$   
 $x > 1$

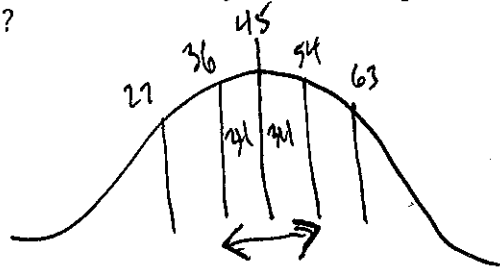
15. Which set of data has the lowest standard deviation?

- (A) {0.1, 0.2, 0.3, 0.4, 0.5}
- (B) {3.5, 3.6, 3.7, 3.8, 3.9}
- (C) {4, 4, 5, 5, 6}
- (D) {9, 9, 9, 9, 9}

*closest data.*

16. The ages of participants in a curling bonspiel are normally distributed with a mean of 45 years and a standard deviation of 9 years. What percent of the curlers are between 36 and 54 years of age?

- (A) 34%
- (B) 68%
- (C) 95%
- (D) 99%



17. The heights of all students in a class were measured. It was later discovered that the tape measure used was inaccurate and 5 mm had to be added to each person's height. Which calculation would stay the same based on the new height measures?

- (A) central tendency
- (B) mean
- (C) median
- (D) standard deviation

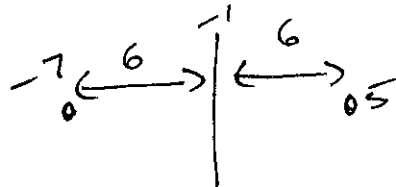
18. What are the domain and range for  $y = 3(x - 1)^2 + 4$ ?

- (A)  $x \in R$  and  $y \leq 4$
- (B)  $x \in R$  and  $y \geq 4$
- (C)  $x \leq 1$  and  $y \in R$
- (D)  $x \geq 1$  and  $y \in R$

*opens up*  
*vertex (+1, 4)*  
*Domain:  $x \in R$*   
*R =  $y \geq 4$*

19. A quadratic function has an x-intercept at  $(-7, 0)$  and an axis of symmetry at  $x = -1$ . What is the other x-intercept?

- (A)  $(-13, 0)$
- (B)  $(-4, 0)$
- (C)  $(5, 0)$
- (D)  $(9, 0)$



20. If  $(-1, 3)$  is the vertex of  $y = 2x^2 + bx + 5$ , what is the value of  $b$ ?

- (A) -12
- (B) -4
- (C) 4
- (D) 12

$$\frac{-b}{2a} = -1$$

$$\frac{-b}{2(2)} = -1 \cdot 4$$

$$-b = -4 \quad b = 4$$

21. The function  $y = x^2 + 6x + 1$  has an axis of symmetry at  $x = -3$ . Which graph best models this function?

opens up

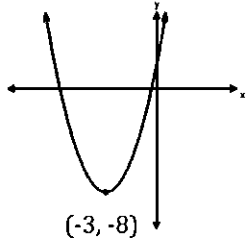
vertex  $x = \frac{-b}{2a} = \frac{-6}{2(1)} = -3$

$$y = (-3)^2 + 6(-3) + 1$$

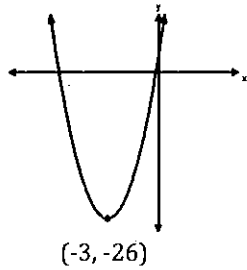
$$= 9 - 18 + 1$$

$$= -8$$

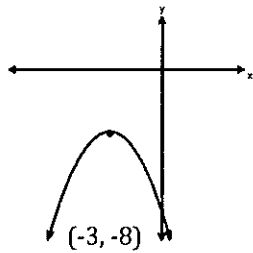
(A)



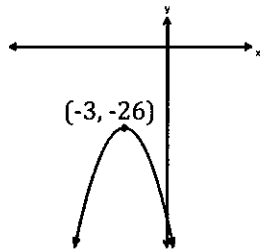
(B)



(C)



(D)

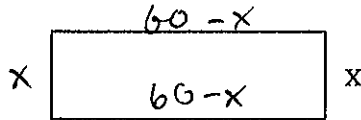


22. Which represents a quadratic function with no x-intercepts?

- (A)  $y = -(x - 1)^2$   
 (B)  $y = -(x - 1)^2 + 3$   
 (C)  $y = (x + 1)^2 - 3$   
 (D)  $y = (x + 1)^2 + 3$

a) v: (1, 0) op. ↓ ~~✗~~  
 b) v (1, 3) op ↓ ~~✗~~  
 c) (-1, -3) op ↑ ~~✗~~  
 d) vertex (-1, 3) op ↑ ✓  
 $\frac{y}{x}$

23. A gardener has 120 m of fencing to mark off a rectangular vegetable garden. Which function could be used to determine the dimensions that will result in the maximum area?



- (A)  $A = x(x - 60)$   
 (B)  $A = x(x - 120)$   
 (C)  $A = x(60 - x)$   
 (D)  $A = x(120 - x)$

24. Which function has zeros of -3 and 7?

- (A)  $f(x) = (x - 3)(x - 7)$   
 (B)  $f(x) = (x - 3)(x + 7)$   
 (C)  $f(x) = (x + 3)(x - 7)$   
 (D)  $f(x) = (x + 3)(x + 7)$

$(x + 3)(x - 7)$

25. What are the roots of the quadratic equation  $x^2 + 6x - 16 = 0$ ?

- (A)  $x = -8, x = -2$   
 (B)  $x = -8, x = 2$   
 (C)  $x = 8, x = -2$   
 (D)  $x = 8, x = 2$

$(x + 8)(x - 2)$   
 $x = -8$   
 $x = 2$

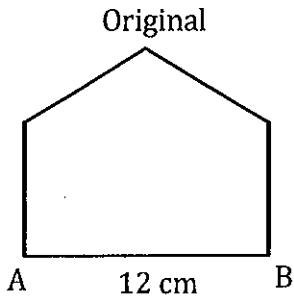
26. Which has a unit rate of \$0.16/apple?

- (A) 20 apples for \$3.00  
 (B) 25 apples for \$4.25  
 (C) 30 apples for \$4.95  
 (D) 35 apples for \$5.60

$\frac{\$5.60}{35} = 0.16$



27. The pentagon shown is transformed by a scale factor of  $\frac{1}{4}$ . What is the length of the image of side AB?



$$12 \times \frac{1}{4} = 3$$

- (A) 3 cm  
(B) 9 cm  
(C) 15 cm  
(D) 48 cm

28. A partially inflated heart-shaped balloon is 15 cm wide and has a volume of 1600 cm<sup>3</sup>. If air is added until the balloon is 30 cm wide, what is the new volume?

- (A) 3200 cm<sup>3</sup>  
(B) 6400 cm<sup>3</sup>  
(C) 9600 cm<sup>3</sup>  
(D) 12 800 cm<sup>3</sup>

$$k = \frac{30}{15} = 2$$

$$\begin{aligned} U &= U_0 \cdot k^3 \\ &= 1600 \times 2^3 \\ &= 12800 \end{aligned}$$

**Constructed Response:**

Answers to be written on this paper in the space provided. Show all workings.

29. Use **both** inductive and deductive reasoning to show that the sum of two odd integers is an even number.

4 marks

Inductive Reasoning

$$3 + 5 = 8 \quad \checkmark$$
$$7 + 9 = 16 \quad \checkmark$$
$$21 + 3 = 24 \quad \checkmark$$

Deductive Reasoning

$$2x + 1, \quad 2x + 3 \quad \text{two odd numbers}$$

$$(2x+1) + (2x+3) = 4x+4$$

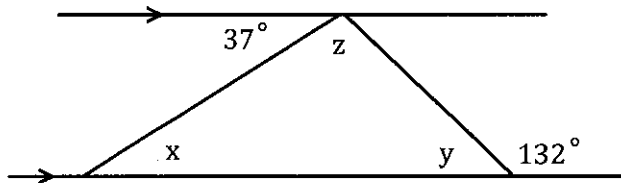
$4x$  is even,  $2(2x)$  double a number.

even plus an even stays even

$\therefore$  sum of two odd is even.

30. Find the measure of each indicated angle. Justify your answer.

3 marks



Angle Measure

Justification

$x = 37^\circ$

alt. int. on transversal

$y = 48^\circ$

supplementary angles

$z = 95^\circ$

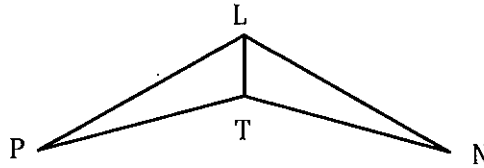
sum of angles in  $\Delta = 180^\circ$

31. Use either a paragraph or two-column format to complete the given proof:

3 marks

Given:  $LT$  bisects  $\angle PLN$   
 $\angle PTL = \angle NTL$

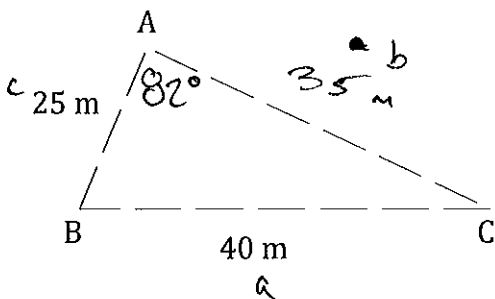
Prove:  $LP = LN$



- ①  $\angle PLT = \angle TLN$  because  $LT$  bisects  $\angle PLN$
- ②  $LT$  shared side.
- ③  $\angle PTL = \angle NTL$  given
- ④  $\triangle PLT \cong \triangle LTN$  by ASA.
- ⑤  $LP = LN$  relative side in congruent  $\triangle$ 's.

32. Peter uses exactly 100 m of string to stake out the triangular plot shown in his back garden. Find the measures of all three angles, to the nearest degree.

4 marks



$$AC = 100 - 25 - 40 = 35 \text{ m}$$

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

$$\cos A = \frac{35^2 + 25^2 - 40^2}{2(35)(25)}$$

$$\cos A = 0.1429$$

$$A = \cos^{-1}(0.1429)$$

$$= 81.7$$

$$= 82^\circ$$

$$\frac{\sin B \cdot 35}{35} = \frac{\sin 82 \cdot 35}{40}$$

$$\sin B = 0.8665$$

$$B = \sin^{-1}(0.8665)$$

$$= 60^\circ$$

$$\angle C = 180 - \angle A - \angle B$$

$$= 38^\circ$$

33. Simplify:  $(3\sqrt{2} - \sqrt{10})^2$

3 marks

$$(3\sqrt{2} - \sqrt{10})(3\sqrt{2} - \sqrt{10}) \text{ Bin}$$

$$9\sqrt{4} - 3\sqrt{20} - 3\sqrt{20} + \sqrt{100}$$

$$18 - 6\sqrt{20} + 10$$

$$28 - 6\sqrt{4} \cdot \sqrt{5}$$

$$28 - 12\sqrt{5}$$

34. State the **restrictions** on  $x$ , **solve** the equation, and **check** for extraneous roots.

4 marks

$$4 - \sqrt{2x+1} = 9 \quad \text{rest. } 2x+1 \geq 0$$

$$2x \geq -1$$

$$x \geq -\frac{1}{2}$$

$$4 - \sqrt{2x+1} = 9$$

$$-\sqrt{2x+1} = 5$$

$$(\sqrt{2x+1})^2 = (-5)^2$$

$$2x+1 = 25$$

$$2x = 24$$

$$x = 12$$

$$\text{check: } 4 - \sqrt{2(12)+1} = 9$$

$$4 - \sqrt{25}$$

$$4 - 5 = -1 \neq 9$$

reject.  
not sol.  
no. sol.

Restrictions:  $x \geq -\frac{1}{2}$

Solution: no solution

35. In a pre-election survey in St. John's, 32% of those surveyed were undecided about their choice for mayor. The survey is considered accurate within 8 percentage points, 99 times out of 100. If there are 102 000 eligible voters in St. John's, state the **range** of the number of people who are undecided and the **confidence level**.

2 marks

level  $\frac{99}{100}$  99%

range:  $32\% - 8\% = 26\%$   
 $32\% + 8\% = 40\%$  } range 2's

$0.26 \times 102000 = 26520$

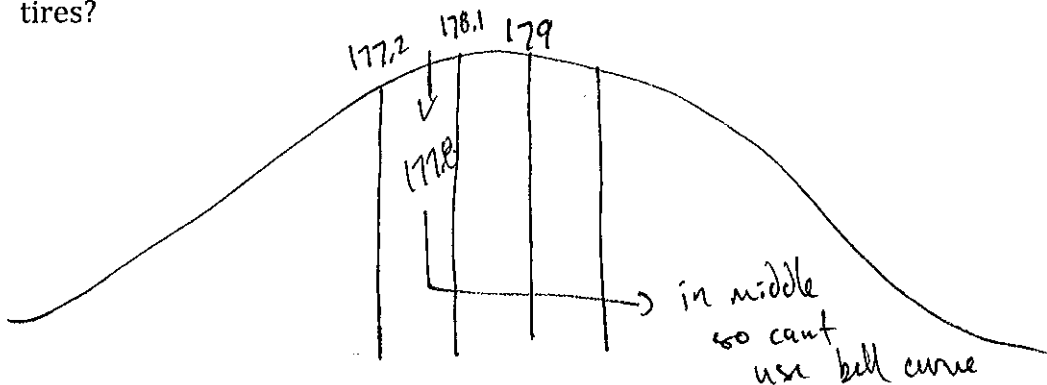
$0.40 \times 102000 = 40800$

Range 26520 - 40800

Confidence Level 99%

36. A manufacturer produces tires that have an average thickness of 179 mm, with a standard deviation of 0.9 mm. To be classified as "supreme quality", tires must have a thickness between 177.8 mm and 180.7 mm. What percent, to the nearest whole number, of the total production can be rated as "supreme quality" tires?

3 marks



must use Z scores

#1  $z = \frac{x - \mu}{\sigma}$   
 $= \frac{177.8 - 179}{0.9}$   
 $= -1.33$

#2  $z = \frac{x - \mu}{\sigma}$   
 $= \frac{180.7 - 179}{0.9}$   
 $= 1.89$

97.06 - 9.18  
 87.88%  
 rated  
 supreme

score gives: 0.0918

score gives: 0.9706

9.18% below

97.06% below

37. A model rocket is launched from its launch pad which is 15 m above the ground. It takes 2 seconds for the rocket to reach a maximum height of 35 m. Algebraically determine the quadratic function in the form  $y = a(x - h)^2 + k$ , that models the path followed by the rocket, and use it to determine the height of the rocket at 3.5 s.

3 marks

max: (2, 35) point (0, 15)

$$y = a(x - 2)^2 + 35$$

$$15 = a(0 - 2)^2 + 35$$

$$\frac{-20}{4} = \frac{4a}{4}$$

$$-5 = a$$

$$y = -5(x - 2)^2 + 35$$

$$y = -5(3.5 - 2)^2 + 35 = 23.75 \text{ m}$$

Function  $y = -5(x - 2)^2 + 35$

Height 23.75 m

38. Algebraically determine the **vertex** and **x-intercepts** for the function  $y = -x^2 - 4x + 5$ . Sketch the graph, labelling all key points.

3 marks

$$y = -x^2 - 4x + 5$$

$$\text{Vertex } x = \frac{-b}{2a} = \frac{-(-4)}{2(-1)} = -2$$

$$y = -(-2)^2 + 4(-2) + 5 = +9$$

vertex: (-2, +9)

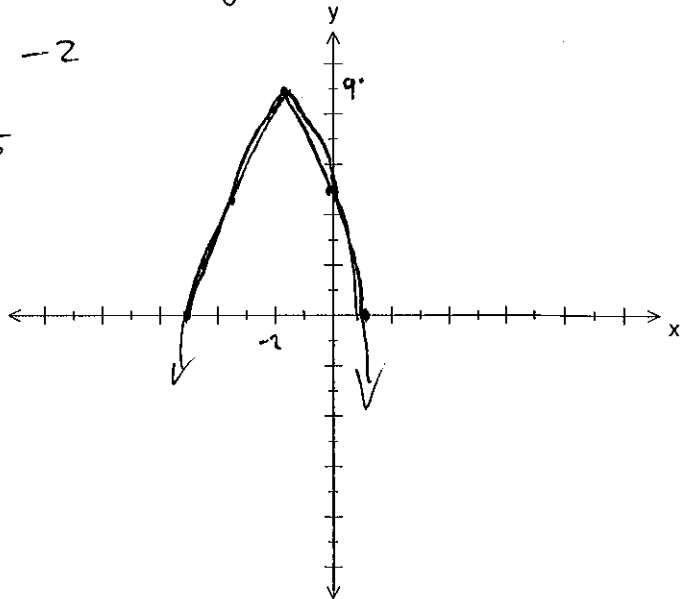
x int: factor or quad form

$$y = x^2 + 4x - 5$$

$$(x + 5)(x - 1)$$

$$x = -5 \quad x = 1$$

y int  $x = 0 \quad y = 5 \quad (0, 5)$



39. Solve the given equation. State the solution(s) in exact form.

3 marks

$$12x = -5x^2 - 1$$

$$5x^2 + 12x + 1 = 0$$

$$a = 5$$

$$b = 12$$

$$c = 1$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-12 \pm \sqrt{(12)^2 - 4(5)(1)}}{2(5)}$$

$$x = \frac{-12 \pm \sqrt{124}}{10}$$

$$\sqrt{124} = \sqrt{4 \cdot 31}$$

$$= 2\sqrt{31}$$

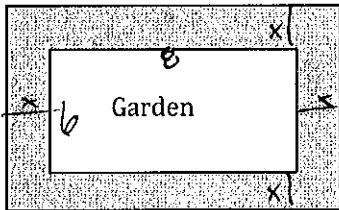
$$x = \frac{-12 \pm 2\sqrt{31}}{10 \div 2}$$

$$x = \frac{-6 \pm \sqrt{31}}{5}$$

40. Use a quadratic function to model and solve the given problem:

4 marks

A landscaper is designing a 6 m by 8 m rectangular garden that will then be surrounded by a uniform border of crushed stone. She has enough crushed stone to cover 72 m<sup>2</sup>. What is the width of the border if she uses all of the crushed stone?



$$A = l \times w = 72 \text{ m}^2 + 48 = 120$$

$$l = 8 + 2x$$

$$w = 6 + 2x$$

$$720 = (8 + 2x)(6 + 2x)$$

$$720 = 48 + 16x + 12x + 4x^2$$

$$720 = 48 + 28x + 4x^2$$

$$0 = -72 + 28x + 4x^2$$

$$a = 4$$

$$b = 28$$

$$c = -72$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-28 \pm \sqrt{(28)^2 - 4(4)(-72)}}{2(4)}$$

$$x = \frac{-28 \pm \sqrt{1936}}{8}$$

$$x = \frac{-28 \pm 44}{8}$$

$$x = \frac{-28 - 44}{8} \quad x = \frac{-28 + 44}{8}$$

extraneous  $x = 2$  ✓

width of crushed stone border is 2 m.

41. Nicole designed a rectangular crest that was 8 cm by 10 cm for her school's jacket. The crest was then enlarged to create a poster that had an area of 980 cm<sup>2</sup>. What are the dimensions of the poster?

3 marks

$$A = l \cdot w = 8 \times 10 = 80 \text{ cm}^2$$

$$k^2 = \frac{\text{scale area}}{\text{orig area}}$$

$$k^2 = \frac{980}{80}$$

$$\sqrt{k^2} = \sqrt{12.25}$$

$$k = 3.5$$

$$l = 10 \times 3.5 = 35 \text{ cm}$$

$$w = 8 \times 3.5 = 28 \text{ cm}$$

$$\text{check: } 35 \times 28 = 980 \text{ cm}^2 \checkmark$$

The dim of the poster are 35 cm x 28 cm.