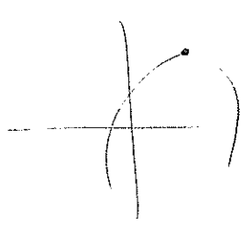
PART A: **SHORT ANSWER.** **(27 marks)**

Place your final answer in the space provided. (1 mark each)

1. Given the line segment EF where E (4, -5) and F (-6, 1),
   find:
   a) the slope of EF $\frac{1-(-5)}{-6-4}=\frac{6}{-10}$ $-\frac{3}{5}$
   b) the midpoint of EF $\frac{4+(-6)}{2}, \frac{-5+1}{2}$ $(-1, -2)$
2. State the slope of a line perpendicular to $\frac{8y}{8} = \frac{-3x}{8} + \frac{24}{8}$ $\frac{8}{3}$
3. Find the distance from the origin to the point (-5, 12). 13
4. Is the ordered pair (3, -2) the solution to the system:
   $2x - y = 8$ $2(3)-(-2) = 6+2 = 8$
   $x + 4y = 11$ $3+4(-2) = 3-8 = -5$ not a solution
5. Write the equation of a circle with centre (0, 0) and radius 7. $x^2+y^2=49$
6. Given the circle $x^2 + y^2 = 100$, state:
   a) the y-intercepts $(0,10)$ & $(0,-10)$
   b) the diameter 20
7. Factor completely:
   a) $x^2 + 5x - 14$ $(x+7)(x-2)$
   b) $x^2 - 9y^2$ $(x-3y)(x+3y)$
   c) $4x^2 - 44x + 121$ $(2x-11)^2$
8. Expand and simplify: $(x + 8)(x - 4)$. $x^2+4x-32$
9. Given the relation $y = (x+1)(x-9)$, state:
   a) the zeros -1 and 9
   b) the equation of the axis of symmetry $x=4$
   c) the vertex $(4,-25)$
10. Given the relation $y = 3x^2 - 4x + 11$, state:
    the y-intercept 11
11. Given the relation $y = -\frac{1}{4}(x - 6)^2 + 15$, state:
    a) the direction of opening down
    b) the vertex $(6,15)$
    c) the optimum value 15
    d) the number of real roots two



12. Give an example of a quadratic relation whose graph is narrower than the graph of $y = x^2$.

$y = 2x^2$

13. Use first and second differences to determine whether the function is linear, quadratic, or neither.

x	1	2	3	4	5
y	2	3	6	11	18

Quadratic

14. Determine the equation of a parabola, in vertex form, that has been reflected in the x-axis and translated 12 units right.

$y = -(x-12)^2$

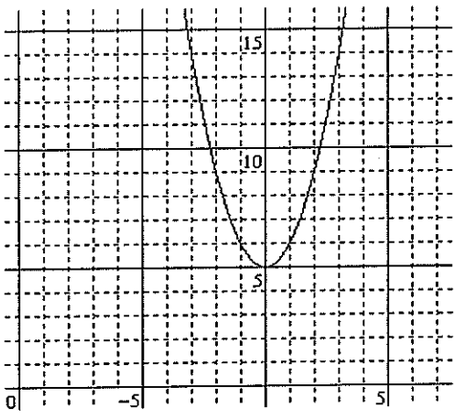
15. For the quadratic relation $y = 7x^2 + 3x - 1$, is the optimum value a maximum or a minimum?

minimum

16. Identify the graph of $y = -x^2 + 5$.

c)

a)



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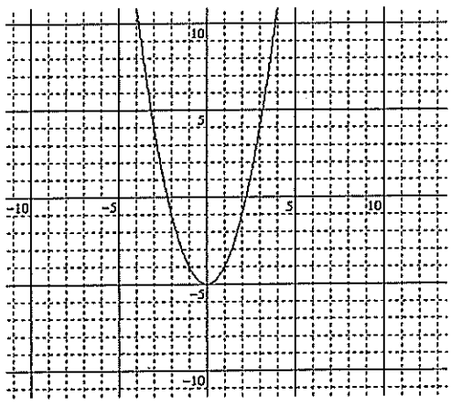

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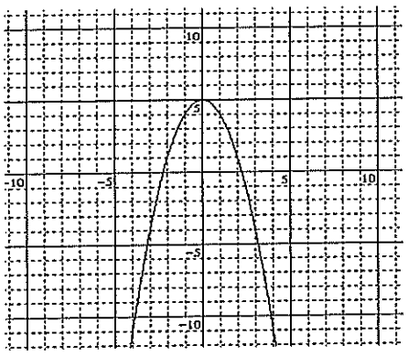
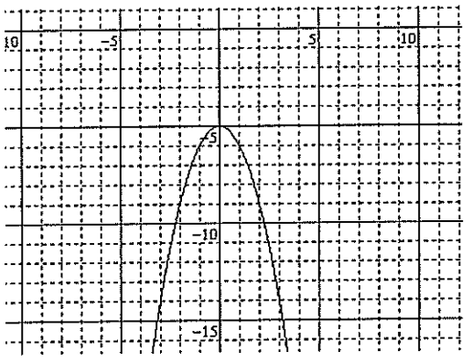


d)



17. Determine $\sin 71°$ to 4 decimal places.

0.9455

18. Solve for A to the nearest degree: $\tan A = \frac{7}{8}$.

41°

PART B: **FULL SOLUTIONS REQUIRED.** **(72 marks)**
Show **ALL** work **NEATLY** in the space provided.

1. Solve the linear system using either substitution or elimination. **(4 marks)**

$4x - 7y = -41$ ①
$3x + 2y = -9$ ②

① ×3 $12x - 21y = -123$
② ×4 $12x + 8y = -36$
① − ② $-29y = -87$
$\frac{-29y}{-29} = \frac{-87}{-29}$
$y = 3$

Sub. $y = 3$ into ②
$3x + 2(3) = -9$
$3x + 6 = -9$
$3x = -9 - 6$
$3x = -15$
$x = -5$

∴ Solution of the system is $(-5, 3)$

2. 355 students purchased prom tickets. Tickets purchased in advance cost \$50 and tickets purchased at the door cost \$60. If a total of \$18 370 was collected, how many of each type of ticket were sold? **(3 marks)**

a) Define the two variables needed to create a system of equations.

Let x represent tickets purchased in advance
Let y represent tickets purchased at the door

b) Create the two equations needed to solve this model. **DO NOT SOLVE.**

1st equation: $x + y = 355$

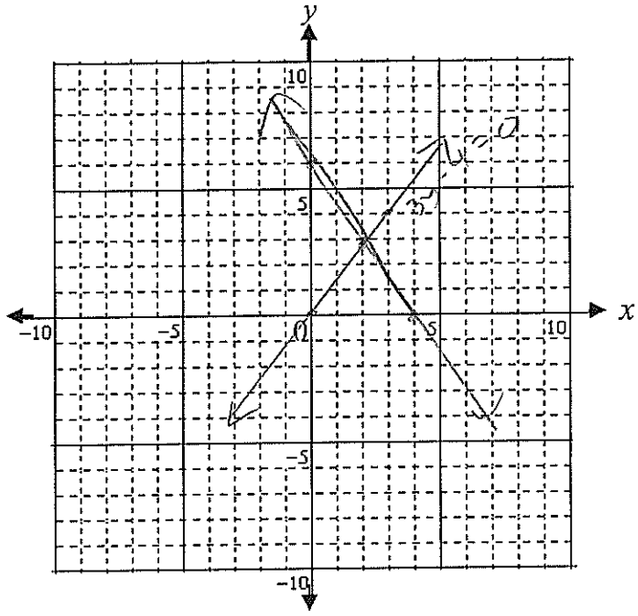
2nd equation: $50x + 60y = 18370$

3. The sides of a triangle are formed by the x-axis, the line $3y - 4x = 0$, and the line $y = \frac{-2}{3}x + 6$.

$3y = 4x$
$y = \frac{4}{3}x$

a) Graph the triangle on the grid below. **(3 marks)**

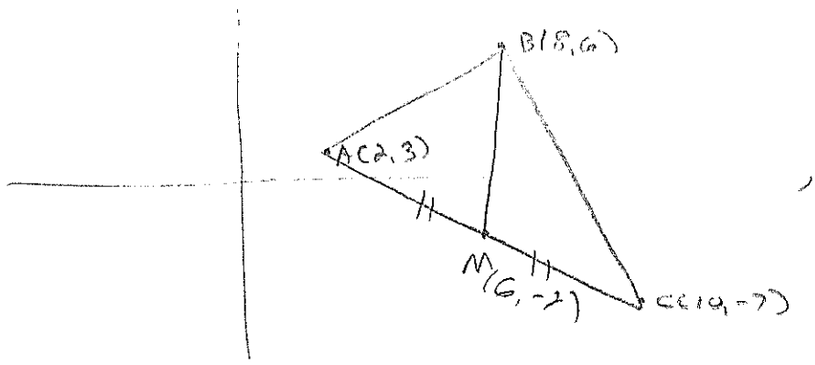
b) State the coordinates of the three vertices of the triangle. **(3 marks)**



(0, 0)
(2, 3)
(4, 0)

4. Triangle ABC has vertices A (2, 3), B (8, 6), and C (10, -7).

a) Make a labeled sketch of this information, *including the information provided in part b).* **(1 mark)**



b) Determine the equation of the median from **B** to side **AC**. (*Include the median in your sketch above.)* **(4 marks)**

midpoint of AC $= \left(\frac{2+10}{2}, \frac{3+(-7)}{2}\right)$

$= \left(\frac{12}{2}, -\frac{4}{2}\right)$

$= (6, -2)$

slope of BM $= \frac{-2-6}{6-8}$

$= \frac{-8}{-2}$

$= 4$

sub. $y = 4x + b$

sub in $(8, 6)$

$6 = 4(8) + b$

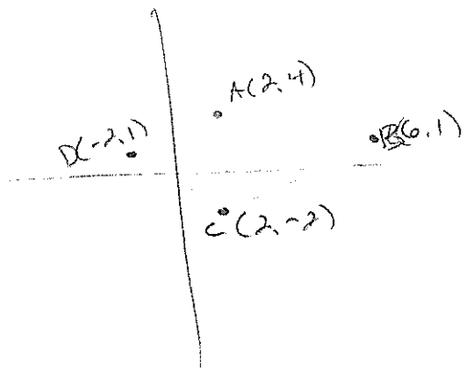
$6 = 32 + b$

$6 - 32 = b$

$-26 = b$

$\therefore y = 4x - 26$

5. Quadrilateral ABCD has vertices at A (2, 4), B (6, 1), C (2, -2), and D (-2, 1) **with all sides equal in length**. Is ABCD a square or a rhombus? Explain your answer and support your conclusion with the appropriate calculations. **(4 marks)**



$m_{AB} = \frac{1-4}{6-2}$

$= -\frac{3}{4}$

$m_{CD} = \frac{-2-1}{2-(-2)}$

$= -\frac{3}{4}$

$m_{BC} = \frac{1-(-2)}{6-2}$

$= \frac{3}{4}$

$m_{AD} = \frac{4-1}{2-(-2)}$

$= \frac{3}{4}$

$\therefore$ rhombus → sides are parallel and not a square as the y are not negative reciprocals

6. Expand and simplify each of the following: **(4 marks)**

a) $-2(3x+5)(x-1)$

$= -2(3x^2 - 3x + 5x - 5)$

$= -2(3x^2 + 2x - 5)$

$= -6x^2 - 4x + 10$

b) $10(x+7)^2$

$= 10(x+7)(x+7)$

$= 10(x^2 + 14x + 49)$

$= 10x^2 + 140x + 490$

7. A parabola that is congruent to the parabola given by $y = \frac{1}{5}x^2$, has zeros at -2 and 8 and has a minimum value of 17. Determine the equation of the parabola, in *vertex form*. **(3 marks)**

$y = a(x-h)^2 + k$

$a = \frac{1}{5}$

zeros -2 & 8

$k = 17$

x-coord of vertex $= \frac{-2+8}{2}$

$= \frac{6}{2}$

$= 3$

$\therefore y = \frac{1}{5}(x-3)^2 + 17$

8. Determine the roots or zeros of the following quadratic equation using the ***most appropriate*** algebraic method. **(3 marks)**

$3x^2 - 15x - 150 = 0$

$3(x^2 - 5x - 50) = 0$

$3(x-10)(x+5) = 0$

$\therefore x = 10$ or $x = -5$

9. For the parabola represented by $y = -6x^2 + 48x - 11$, use the method of completing the square to **determine its vertex. (3 marks)**

$y = -6x^2 + 48x - 11$

$= -6(x^2 - 8x) - 11$

$= -6(x^2 - 8x + 16 - 16) - 11$

$= -6(x-4)^2 + 96 - 11$

$= -6(x-4)^2 + 85$

vertex $(4, 85)$

10. Find the roots of the quadratic equation: $5(x-1)^2 - 180 = 0$. **(3 marks)**

$5(x-1)(x-1) - 180 = 0$

$5(x^2 - 2x + 1) - 180 = 0$

$5x^2 - 10x + 5 - 180 = 0$

$5x^2 - 10x - 175 = 0$

$5(x^2 - 2x - 35) = 0$

$5(x-7)(x+5) = 0$

$\therefore x = 7$ or $x = -5$

11. A rocket is launched into the air and its path is approximated by the relation $h = -4t^2 + 24t + 1$, where h is the height of the rocket above the ground in metres, and t is the elapsed time in seconds.

a) What is the maximum height of the rocket? **(3 marks)**

$h = -4t^2 + 24t + 1$

$= -4(t^2 - 6t) + 1$

$= -4(t^2 - 6t + 9 - 9) + 1$

$= -4(t-3)^2 + 36 + 1$

$= -4(t-3)^2 + 37$

∴ the maximum height of the rocket is 37m

b) When does the rocket reach its maximum height? **(1 mark)**

reached its maximum after 3 seconds

c) When does the rocket hit the ground? (Round your answer to 1 decimal place.) **(3 marks)**

sub. in $h = 0$

$0 = -4t^2 + 24t + 1$

$a = -4$, $b = 24$, $c = 1$

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

$= \frac{-24 \pm \sqrt{24^2 - 4(-4)(1)}}{2(-4)}$

$= \frac{-24 \pm \sqrt{576 + 16}}{-8}$

$= \frac{-24 \pm \sqrt{592}}{-8}$

$x \doteq \frac{-24 \pm 24.3}{-8}$

$x \doteq \frac{-24 - 24.3}{-8}$ or $x \doteq \frac{-24 + 24.3}{-8}$

$\doteq \frac{-48.3}{-8}$ $\doteq -0.0375$

$\doteq 6.0$

∴ it will hit the ground after 6.0 seconds

d) How high is the launch pad? **(1 mark)**

sub $t = 0$

$h = -4(0)^2 + 24(0) + 1$

$= 1$

∴ the launch pad was 1m high

12. For the relation $y = 2(x + 7)^2 - 3$:

describe the transformations (in words) applied to the graph of $y = x^2$ to obtain the graph of this quadratic relation. **(3 marks)**

$a = 2$ → vertical stretch factor 2

$h = 7$ → left 7 units

$k = -3$ → down 3 units

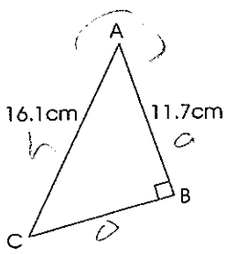
13. On a sunny day, a tower casts a shadow 39.1 m long. At the same time, a 1.6 m parking meter casts a shadow 5.2 m long. How high is the tower to the nearest tenth of a metre? Include a properly labeled diagram in your solution. **(3 marks)**

$$\frac{x}{1.6} = \frac{39.1}{5.2}$$

$$\frac{5.2x}{5.2} = \frac{62.56}{5.2}$$

$$x \doteq 12.0 \text{ m}$$

14. Determine, to the nearest degree, the measure of angle A. **(2 marks)**

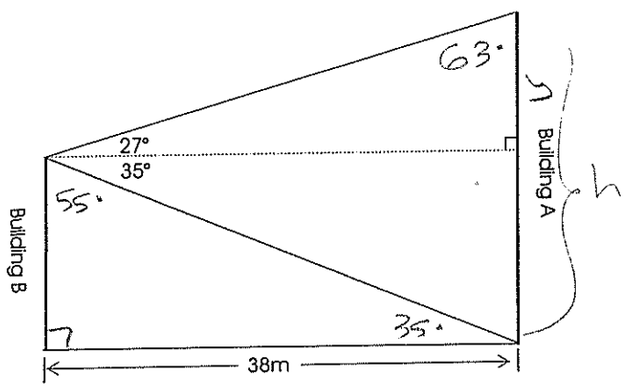


$$\cos A = \frac{11.7}{16.1}$$

$$\cos A \doteq 0.7267$$

$$\angle A \doteq 43°$$

15. Two buildings are 38 m apart. From the top of the shorter building, Building B, the angle of elevation of the top of the taller building, Building A, is $27°$ and the angle of depression of the base is $35°$. Determine the height of the taller building to the nearest metre. **(5 marks)**



$$\tan 35° = \frac{x}{38}$$

$$x = 38 \tan 35°$$

$$x \doteq 26.6 \text{ m}$$

$$\tan 27° = \frac{y}{38}$$

$$y = 38 \tan 27°$$

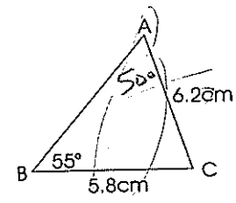
$$\doteq 19.4 \text{ m}$$

$h = x + y$

$= 26.6 + 19.4$

$= 46 \text{ m}$

16. Solve for all of the unknown **angles** in the following triangle. Round all final answers to the nearest degree. **(3 marks)**



$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{5.8}{\sin A} = \frac{6.2}{\sin 55°}$

$\sin A = \frac{5.8 \sin 55°}{6.2}$

$\sin A \doteq 0.7663$

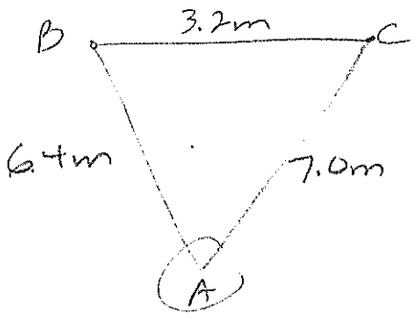
$\angle A \doteq 50°$

correction is below angle C is 75 degrees

$\angle C = 180° - 50° - 55°$

$= 75°$

17. A soccer net is 3.2 m wide. A player is 6.4 m from one goalpost and 7.0 m from the other. Within what angle must she keep her shot in order to score a goal (to the nearest degree)? **(3 marks)**



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

$3.2^2 = 7^2 + 6.4^2 - 2(7)(6.4)\cos A$

$10.24 = 49 + 40.96 - 89.6\cos A$

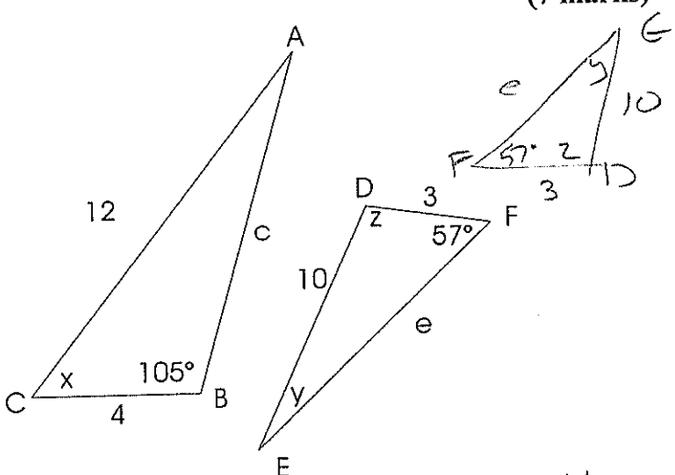
$10.24 - 49 - 40.96 = -89.6\cos A$

$\frac{-79.72}{-89.6} = \frac{-89.6\cos A}{-89.6}$

$0.8897 \doteq \cos A$

$27° = \angle A$

18. If ΔABC is similar to ΔEDF, determine the measures of the unknown sides and angles, using the properties of similar triangles. (Show your work.) **(7 marks)**



$\frac{4}{3} = \frac{c}{10}$

$3c = 40$

$c = 13.3$

$\frac{12}{e} = \frac{4}{3}$

$4e = 36$

$e = 9$

x = 57°

y = 18°

z = 105°

c ≐ 13.3

e = 9