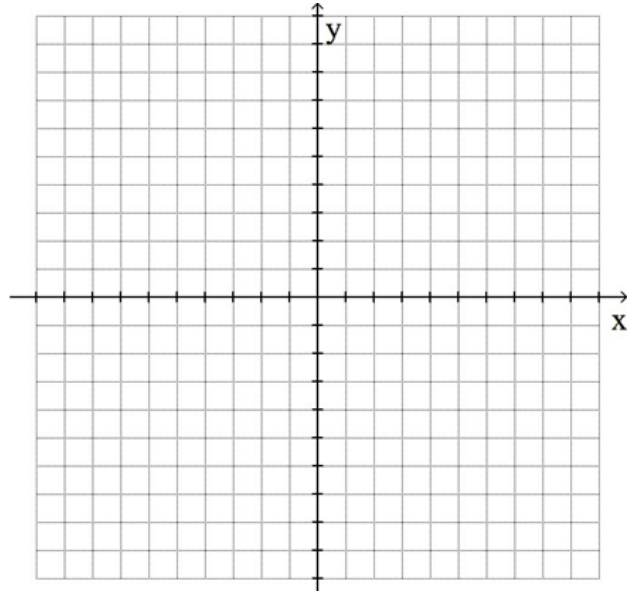Word Problems: Solving a System of Equations (Quadratic/ Linear)

1. Consider the line ℓ passing through points A (0,7) and B (3,1) and the parabola
   with vertex V (1,1) passing through the point C (-1,9). Find the points of intersection
   P and Q of the parabola and the line.

Ans: _____

2. Mohammed and Malik each decided to start saving their spare change in their piggy banks.
They agreed to do so for 24 weeks to see who is the better saver.
The change in the value of Malik's piggy bank is represented by a parabola. Malik started his
savings by putting $30 in his bank. After 10 weeks Malik's piggy reached its maximum value
of $80.
Mohammed appears to have been a more consistent saver. He started his savings with an initial

investment of $54, and after 9 weeks his piggy bank value had increased by $\frac{1}{3}$.

Determine the number of weeks that Malik had more money in his piggy bank.

Value of piggy bank ($)
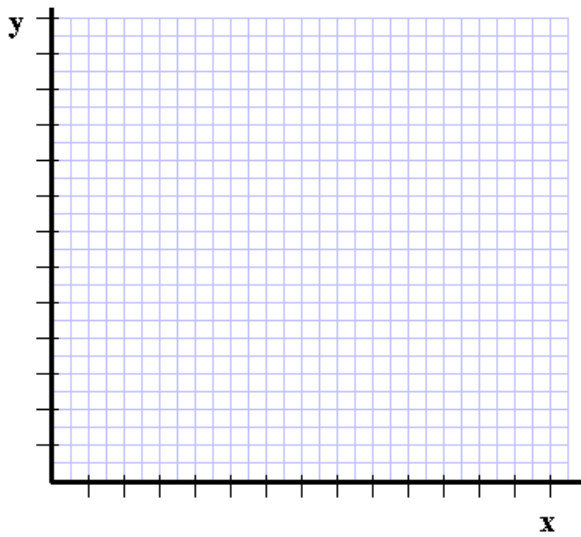
Time period (weeks)
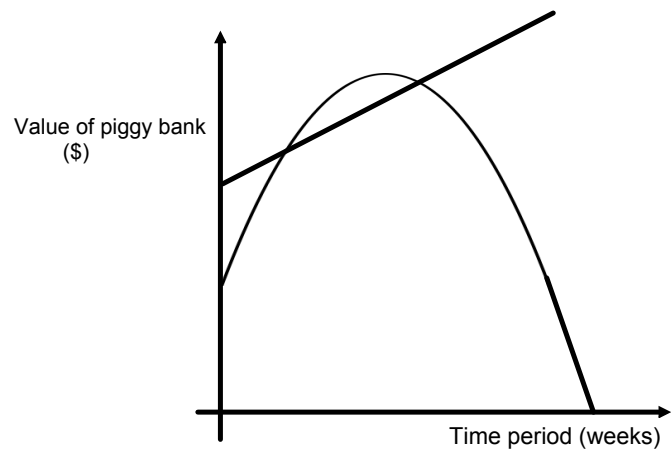
Ans: _____

3. Two competing fitness centres are each having a promotion to attract new members.

   The rule $y = \frac{1}{4}x^2 + 50$ gives the number of members at club A and the rule y = 10x - 25

   gives the number of members at club B since the start of the their promotions (x $\geq$ 3).

   a) Represent this situation in the Cartesian plane given below.

   b) How many days after the start of the promotion do the two centres have the same number of members?

Ans: _____

   c) How many days after the start of the promotion does centre B have as many or more members than centre A?

Ans: _____

4. The Math and French clubs tracked their numbers of members over a 20-week period.
   The number of members of the French club is represented by a parabola.
   At the beginning the French club had 28 members, and its membership reached its
   minimum at 10 weeks, with only 3 members.

   The Math club membership is represented by a straight line. The initial number of
   members was 10. After 10 weeks the membership had increased by 50%.

   Determine the number of weeks in which the Math club had more members than
   the French club.

Number of
members

Time (weeks)
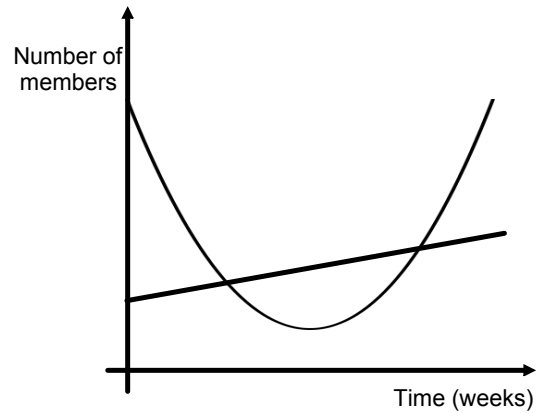
Ans: _____

5. A batter hits a baseball from home plate. The path of the ball describes a parabolic trajectory. When the ball reaches its maximum height, 15 metres, it has travelled a horizontal distance of 50 metres from home plate.

   A spotlight which is 20 metres above the ground, and 93 metres from home plate shines a beam of light onto the field. This beam hits the ground a distance of 68 metres from home plate.

   At what height will the ball cross the beam of light?
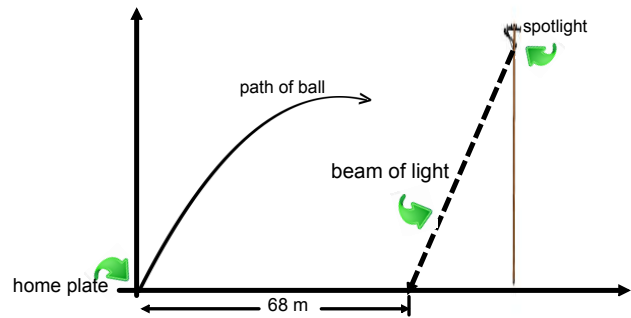
Ans: _____

6. Two projectiles are launched simultaneously. The heights (in m), h_1 (t) and h_2 (t) of the two projectiles as a function of time (t) in seconds since their launch are given by the rules h_1 (t) = -2 t^2 + 20t + 50 and h_2 (t) = 2t + 66.

a) How long after their launch will the two projectiles be at the same height?

b) Over what interval of time since the launch is the 1st projectile higher than the 2nd?

a) Ans: _____

b) Ans: _____

7. A study involved looking at the population changes for two competing animal species in a closed environment. The population change for species A is described by a quadratic function. At the beginning of the study, this species consisted of 145 individuals. By the eleventh month, the population of this species had reached a peak of 210 individuals.

    At the beginning of the study, species B consisted of 125 individuals. Six months later, this number had risen by 20%. The population change for species B is described by a linear function. During which month did the population of species B exceed that of species A?

    Clearly show all your work.
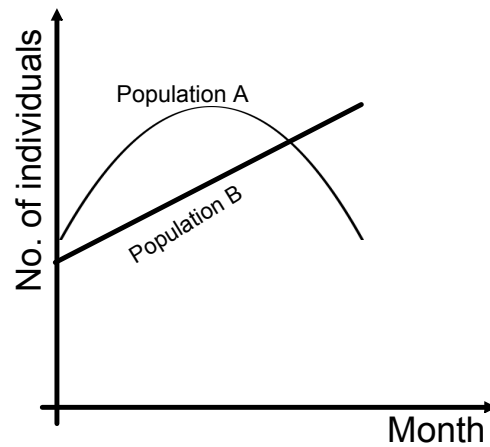
Ans: _____

8. A parabolic mirror is represented in the system below, where the units are measured in centimetres. The parabola passes through point (8, 7.75) and its vertex is point (21, 3).

A light ray, which is parallel to the y-axis, strikes the mirror and is reflected in a straight line passing through points (18, 8.25) and (21, 12).

At what distance from the y-axis does the light ray strike the parabolic mirror? Round off your answer to the nearest unit.
Clearly show all your work.

Light ray

Reflected light ray

?
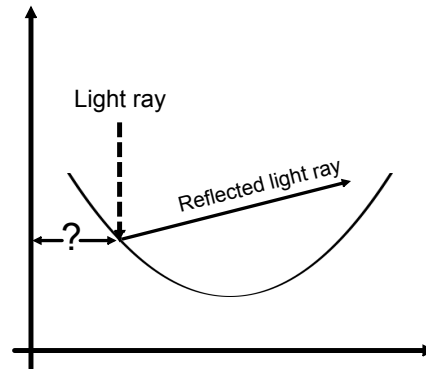
Ans: _____

Answers

1. (2, 3) and (-1, 9)

2. 8 weeks (from week 4 to week 12)

3. b) after 10 days, and again after 30 days

   c) For a period of 20 days (between day 10 and day 30):

4. During 14 weeks (from week 4 to week 18)

5. 9.6 metres

6. a) After 1 second, and again after 8 seconds

   b) for a period of time of 7 seconds, between 1 second

      and 8 seconds.

7. After 16.5 months, which is during the 17th month.

8. 15 cm (14.69 cm rounded to the nearest unit)