

Dr Oliver Mathematics
Mathematics Standard Grade: Credit Level
2013 Paper 1: Non-Calculator
55 minutes

The total number of marks available is 38.
You must write down all the stages in your working.

1. Evaluate

$$86.5 - 3.651 \times 20.$$

(2)

Solution

E.g.,

$$\begin{aligned} 86.5 - (3.651 \times 20) &= 86.5 - (36.51 \times 2) \\ &= 86.5 - 73.02 \\ &= \underline{\underline{13.48}}. \end{aligned}$$

2. Evaluate

$$\frac{1}{2} \div 2\frac{2}{3}.$$

(2)

Solution

$$\begin{aligned} \frac{1}{2} \div 2\frac{2}{3} &= \frac{1}{2} \div \frac{8}{3} \\ &= \frac{1}{2} \times \frac{3}{8} \\ &= \underline{\underline{\frac{3}{16}}}. \end{aligned}$$

3. A group of people attended a course to help them stop smoking.

The following table shows the statistics before and after the course.

(2)

	Mean number of cigarettes	Standard deviation
Before	20.8	8.5
After	9.6	12.0

Make **two** valid comments about these results.

Solution

Mean: Since the mean for 'Before' (20.8) is higher than the mean for 'After' (9.6), on average, fewer cigarettes were smoked per person after the course.

Standard deviation: Since the standard deviation for 'Before' (8.5) is lower than the standard deviation for 'After' (12.0), the number of cigarettes smoked per person was more varied after the course.

4. Change the subject of the formula to r :

(2)

$$A = 4\pi r^2.$$

Solution

$$\begin{aligned} A = 4\pi r^2 &\Rightarrow r^2 = \frac{A}{4\pi} \\ &\Rightarrow r = \sqrt{\frac{A}{4\pi}}. \end{aligned}$$

5. 150 patients have been given a flu vaccine.

The data is shown in the table below.

Age	Male	Female
5 or under	4	3
6 – 15	7	8
16 – 59	37	47
60 or over	12	32

What is the probability that

- (a) a patient given the flu vaccine was male **and** aged 60 or over?

(1)

Solution

$$\frac{12}{150} = \frac{2}{\underline{25}}$$

- (b) a patient given the flu vaccine was aged 5 or under?

(1)

Solution

$$\frac{4+3}{150} = \frac{7}{\underline{150}}$$

6. Joan buys gold and silver charms to make bracelets.
2 gold charms and 5 silver charms cost £125.

Let g pounds be the cost of one gold charm and s pounds be the cost of one silver charm.

- (a) Write down an equation in terms of g and s to illustrate the above information.

(1)

Solution

$$\underline{\underline{2g + 5s = 125}} \quad (1).$$

4 gold charms and 3 silver charms cost £145.

- (b) Write down another equation in terms of g and s to illustrate this information.

(1)

Solution

$$\underline{\underline{4g + 3s = 145}} \quad (2).$$

- (c) Hence calculate the cost of each type of charm.

(3)

Solution

$$2 \times (1) - (2):$$

$$7s = 105 \Rightarrow s = 15$$

$$\Rightarrow 2g + 75 = 125$$

$$\Rightarrow 2g = 50$$

$$\Rightarrow g = 25;$$

hence, a gold charm costs £25 and a silver charm costs £15.

7. (a) Expand and simplify

$$(2x - 5)(x^2 + 3x - 7).$$

(3)

Solution

\times	x^2	$+3x$	-7
$2x$	$2x^3$	$+6x^2$	$-14x$
-5	$-5x^2$	$-15x$	-35

$$(2x - 5)(x^2 + 3x - 7) = \underline{\underline{2x^3 + x^2 - 29x - 35}}.$$

(b) Solve the inequality

$$4x - 5 \leq 7x - 20.$$

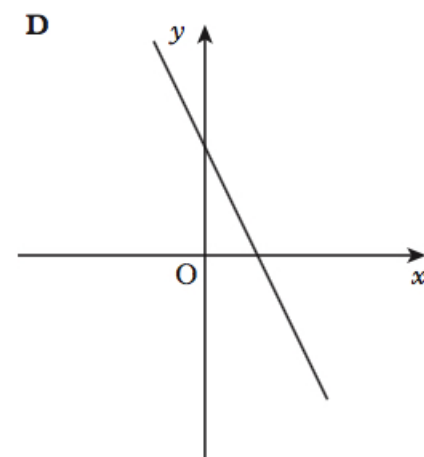
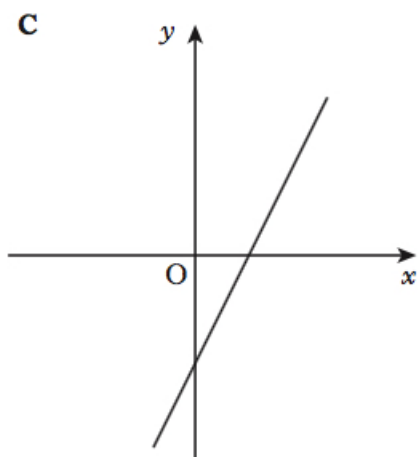
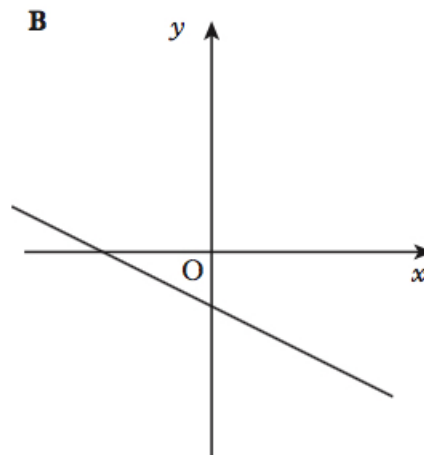
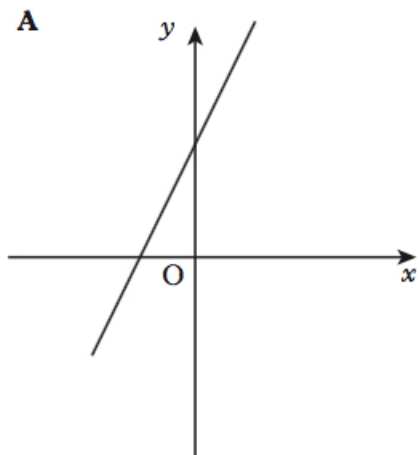
(3)

Solution

$$\begin{aligned} 4x - 5 &\leq 7x - 20 \Rightarrow 15 \leq 3x \\ &\Rightarrow \underline{\underline{x \geq 5}}. \end{aligned}$$

8. Four straight line graphs are shown below.

(3)



Which one of these above could represent the line with equation

$$2x + y = 3?$$

Give **two** reasons to justify your answer.

Solution

$$2x + y = 3 \Rightarrow y = -2x + 3.$$

B and *D* are possible because they have a negative gradient.
D is the answer because the *y*-intercept for *B* is negative.

9. Quick-Smile photographers charge the following rates:

- 50p per photograph for the first 12 photographs printed,

- 35p per photograph for any further photographs printed, and
 - £4.25 for a CD of the photographs.
- (a) How much will it cost to have 16 photographs printed plus a CD? (2)

Solution

$$\begin{aligned} \text{Cost} &= (0.5 \times 12) + (0.35 \times 4) + 4.25 \\ &= 6 + 1.4 + 4.25 \\ &= \underline{\underline{\pounds 11.65}}. \end{aligned}$$

- (b) Find a formula for C , the cost in pounds, of having x photographs printed (where x is greater than 12) plus a CD. (3)

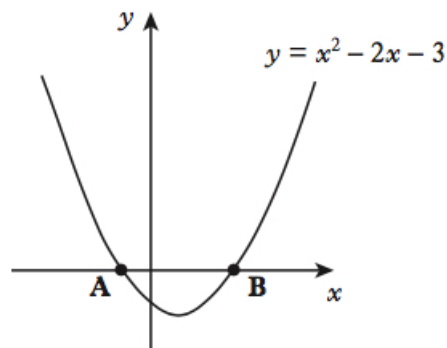
Solution

$$\begin{aligned} \text{Cost} &= (0.5 \times 12) + [0.35 \times (x - 12)] + 4.25 \\ &= 6 + (0.35x - 4.2) + 4.25 \\ &= \underline{\underline{\pounds(0.35x + 6.05)}}. \end{aligned}$$

10. The parabola with equation

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

cuts the x -axis at the points A and B as shown in the diagram.



- (a) Find the coordinates of A and B . (4)

Solution

$$\left. \begin{array}{l} \text{add to: } -2 \\ \text{multiply to: } -3 \end{array} \right\} -3, +1$$

$$\begin{aligned} x^2 - 2x - 3 = 0 &\Rightarrow (x - 3)(x + 1) = 0 \\ &\Rightarrow x - 3 = 0 \text{ or } x + 1 = 0 \\ &\Rightarrow x = 3 \text{ or } x = -1; \end{aligned}$$

hence, $A(-1, 0)$ and $B(3, 0)$.

(b) Write down the equation of the axis of symmetry of

(1)

$$y = x^2 - 2x - 3.$$

Solution

The equation of the axis of symmetry is

$$x = \frac{-1 + 3}{2} \Rightarrow \underline{\underline{x = 1.}}$$

11. Jenny is doing calculations using consecutive numbers.

She notices a pattern which always gives an answer of 1.

Using

$$2, 3, \text{ and } 4 \text{ gives } 3^2 - 2 \times 4 = 1.$$

$$3, 4, \text{ and } 5 \text{ gives } 4^2 - 3 \times 5 = 1.$$

$$4, 5, \text{ and } 6 \text{ gives } 5^2 - 4 \times 6 = 1.$$

(a) Using 8, 9, and 10, write down a similar pattern.

(1)

Solution

$$8, 9, \text{ and } 10 \text{ gives } \underline{\underline{9^2 - 8 \times 10 = 1.}}$$

(b) Using n , $(n + 1)$, and $(n + 2)$, show that the answer is 1 for any three consecutive numbers.

(3)

Solution

$$\begin{array}{r|rr} \times & n & +1 \\ \hline n & n^2 & +n \\ +1 & +n & +1 \\ \hline \end{array}$$

$$\begin{aligned} (n+1)^2 - n(n+2) &= (n^2 + 2n + 1) - (n^2 + 2n) \\ &= \underline{\underline{1}}, \end{aligned}$$

as required.