\( \overrightarrow{GH} = \mathbf{a}, \overrightarrow{HJ} = \mathbf{b} \) and \( \overrightarrow{JK} = \mathbf{c} \).

\( L \) lies on \( GK \) so that \( \overrightarrow{LK} = 3\overrightarrow{GL} \).

Find an expression, in terms of \( \mathbf{a}, \mathbf{b} \) and \( \mathbf{c} \), for \( \overrightarrow{GL} \).

\[
\overrightarrow{GL} = \text{.................................................................} \quad [2]
\]
2. (0580-S 2016-Paper 2/3-Q14)

(a) \( \mathbb{S} = \{x : 2 \leq x \leq 16, x \text{ is an integer}\} \)
\( M = \{\text{even numbers}\} \)
\( P = \{\text{prime numbers}\} \)

(i) Find \( n(M) \).

......................... \[1\]  

(ii) Write down the set \( (P \cup M)' \).

\( (P \cup M)' = \{ \ldots \} \) \[1\]  

(b) On the Venn diagram, shade \( A \cap B' \).

3. (0580-S 2016-Paper 2/1-Q22)

The Venn diagram shows the numbers of elements in each region.

(a) Find \( n(A \cap B') \).

......................... \[1\]  

(b) An element is chosen at random.

Find the probability that this element is in set \( B \).

......................... \[1\]  

(c) An element is chosen at random from set \( A \).

Find the probability that this element is also a member of set \( B \).

......................... \[1\]  

(d) On the Venn diagram, shade the region \( (A \cup B)' \).

[1]
4. (0580-S 2016-Paper 2/2-Q24)

In the diagram, $O$ is the origin, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{AB} = \mathbf{b}$. $P$ is on the line $AB$ so that $AP : PB = 2 : 1$. $Q$ is the midpoint of $BC$.

Find, in terms of $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$, in its simplest form

(a) $\overrightarrow{CB}$,

$$\overrightarrow{CB} = \text{..................................................}$$  [1]

(b) the position vector of $Q$,

$$\text{..................................................}$$  [2]

(c) $\overrightarrow{PQ}$,

$$\overrightarrow{PQ} = \text{..................................................}$$  [2]
5. (0580-W 2016-Paper 2/2-Q15)

The Venn diagram shows the number of people who like films (F), music (M) and reading (R).

(a) Find

(i) \( n(M) \), ................................................. [1]

(ii) \( n(R \cup M) \), ................................................. [1]

(b) A person is chosen at random from the people who like films. Write down the probability that this person also likes music. ................................................. [1]

(c) On the Venn diagram, shade \( M' \cap (F \cup R) \). ................................................. [1]

6. (0580-W 2016-Paper 2/2-Q16)

\[
\overrightarrow{BC} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad \overrightarrow{BA} = \begin{pmatrix} -5 \\ 6 \end{pmatrix}
\]

(a) Find \( \overrightarrow{CA} \).

\[
\overrightarrow{CA} = \begin{pmatrix} \_ \\ \_ \end{pmatrix} \quad [2]
\]

(b) Work out \( |\overrightarrow{BA}| \).

......................................................... [2]
7. \((0580-W\ 2016-Paper\ 2/3-Q18)\)

\[ f(x) = x^2 \quad g(x) = \frac{x - 3}{2} \]

Find

(a) \(f(-5)\),

\[ \text{...........................................[1]} \]

(b) \(gf(x)\),

\[ \text{...........................................[1]} \]

(c) \(g^{-1}(x)\).

\[ g^{-1}(x) = \text{...........................................[2]} \]
8. \((0580-W \ 2016\text{-}Paper\ 2/3\text{-}Q20)\)

(a) \(\mathcal{E} = \{7, 9.3, \pi, \frac{5}{9}, 2\sqrt{3}\}\)

\(A = \{\text{integers}\}\)

\(B = \{\text{irrational numbers}\}\)

Write all the elements of \(\mathcal{E}\) in their correct place on the Venn diagram.

(b) Shade the region in each of the Venn diagrams below.

[Diagrams]

[2]

[2]
9. (0580-W 2016-Paper 2/1-Q22)

(a) \( n(\mathbb{E}) = 10, \ n(A) = 7, \ n(B) = 6, \ n(A \cup B)' = 1. \)

(i) Complete the Venn diagram by writing the number of elements in each subset. \[2\]

(ii) An element of \( \mathbb{E} \) is chosen at random.

Find the probability that this element is an element of \( A' \cap B. \)

........................................... \[1\]

(b) On the Venn diagram below, shade the region \( C' \cap D'. \)

........................................... \[1\]
10. (0580-S 2017-Paper 2/3-Q9)

(a) \( \overrightarrow{GH} = \begin{pmatrix} 6 \\ -4 \end{pmatrix} \)

Find

(i) \( 5\overrightarrow{GH} \),

(ii) \( \overrightarrow{HG} \).

(b) \( \begin{pmatrix} 6 \\ 7 \end{pmatrix} + \begin{pmatrix} 2 \\ y \end{pmatrix} = \begin{pmatrix} 8 \\ 3 \end{pmatrix} \)

Find the value of \( y \).

\[ y = \text{____________________________}_{} [1] \]

11. (0580-S 2017-Paper 2/3-Q12)

\( f(x) = 3 + 4x \quad g(x) = 6x + 7 \)

Find, in its simplest form,

(a) \( f(3x) \),

(b) \( fg(x) \).

\[ \text{____________________________}_{} [1] \]
\[ \text{____________________________}_{} [2] \]
12. (0580-S 2017-Paper 2/1-Q17)

(a) In this Venn diagram, shade the region $F \cup G'$.

(b) $\mathbb{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$A = \{x: x$ is an odd number$\}$

$B = \{x: x$ is a square number$\}$

$C = \{x: x$ is a multiple of 3$\}$

(i) Write all the elements of $\mathbb{E}$ in the Venn diagram below.

(ii) Another number is included in the set $\mathbb{E}$. This number is in the region $A \cap B \cap C$.

Write down a possible value for this number.

.................................................. [1]
13. \((0580\text{-}S\ 2017\text{-}Paper\ 2/3\text{-}Q17)\)

\[\overrightarrow{OP} = \mathbf{p} \text{ and } \overrightarrow{OQ} = \mathbf{q}.
\]

\(Z\) is a point on \(PQ\) such that \(PZ : ZQ = 5 : 2\).

Work out, in terms of \(\mathbf{p}\) and \(\mathbf{q}\), the position vector of \(Z\).

Give your answer in its simplest form.

\[\text{...[3]}\]

14. \((0580\text{-}S\ 2017\text{-}Paper\ 2/1\text{-}Q18)\)
The diagram shows a parallelogram $OCEG$.

$O$ is the origin, $\overrightarrow{OA} = a$ and $\overrightarrow{OB} = b$.

$BHF$ and $AHD$ are straight lines parallel to the sides of the parallelogram.

$\overrightarrow{OG} = 3\overrightarrow{OA}$ and $\overrightarrow{OC} = 2\overrightarrow{OB}$.

(a) Write the vector $\overrightarrow{HE}$ in terms of $a$ and $b$.

$$\overrightarrow{HE} = \text{...}$$ [1]

(b) Complete this statement.

$a + 2b$ is the position vector of point $\text{...}$ [1]

(c) Write down two vectors that can be written as $3a - b$.

$\text{...}$ and $\text{...}$ [2]
15. (0580-S 2017-Paper 2/2-Q23)

(a) \( \mathcal{E} = \{ \text{students in a class} \} \)
\( P = \{ \text{students who study physics} \} \)
\( C = \{ \text{students who study chemistry} \} \)

The Venn diagram shows numbers of students.

\[ \begin{array}{ccc}
\mathcal{E} & \{ \} & \{ \} \\
\{ & P & C \\
5 & 11 & 8 \\
7 & & \\
\end{array} \]

(i) Find the number of students who study physics or chemistry.

\[ \text{..........................} [1] \]

(ii) Find \( n(P \cap C') \).

\[ \text{..........................} [1] \]

(iii) A student who does not study chemistry is chosen at random.

Find the probability that this student does not study physics.

\[ \text{..........................} [1] \]

(b) On the Venn diagram below, shade the region \( D \cup E' \).

\[ \begin{array}{ccc}
\mathcal{E} & \{ \} & \{ \} \\
\{ & D & E \\
& & \\
\} & & \\
\end{array} \]

[1]