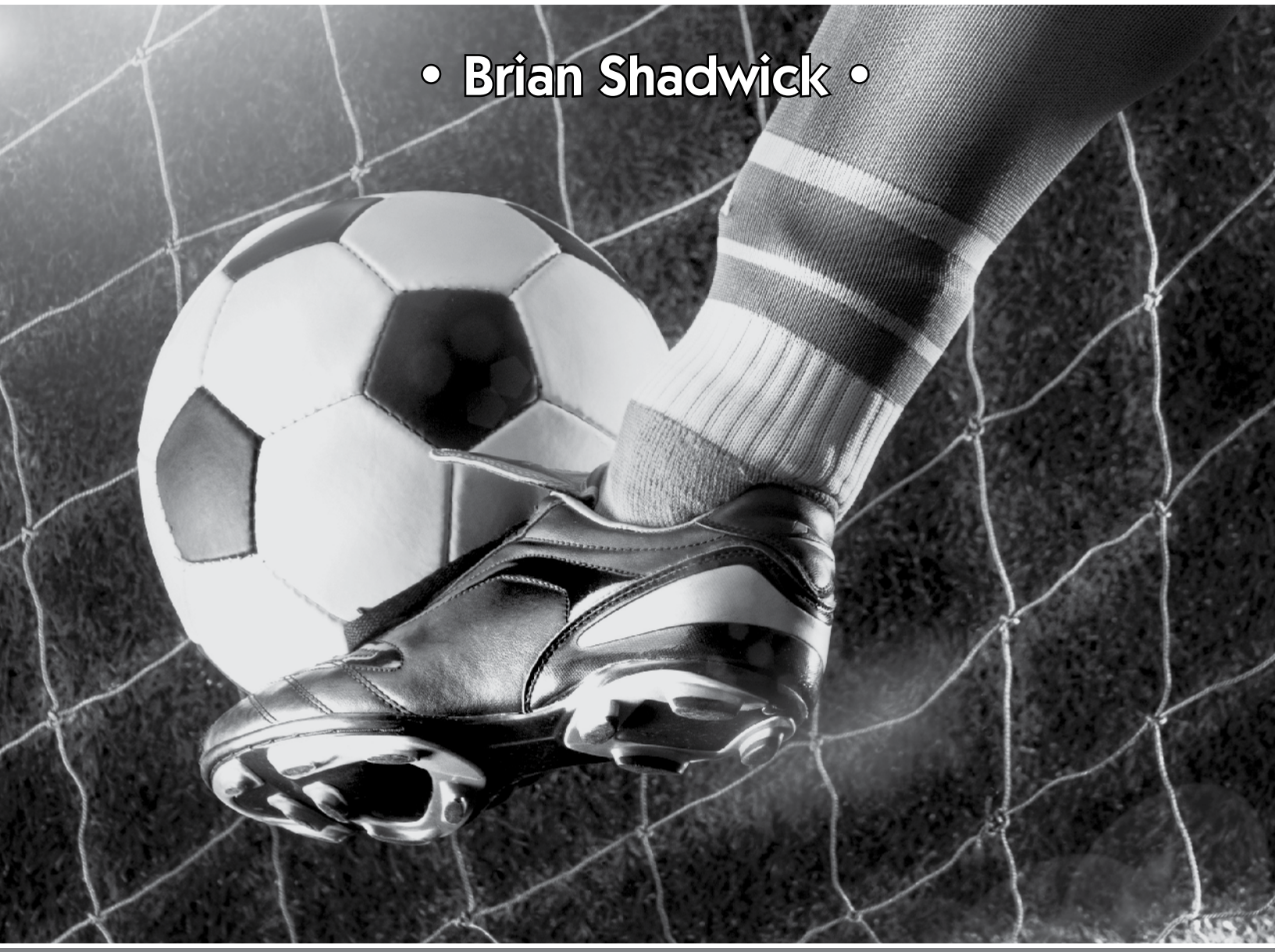
# DOT POINT

## QCE PHYSICS UNITS 3 AND 4



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# Contents

# Words to Watch

**account, account for** State reasons for, report on, give an account of, narrate a series of events or transactions.

**analyse** Interpret data to reach conclusions.

**annotate** Add brief notes to a diagram or graph.

**apply** Put to use in a particular situation.

**assess** Make a judgement about the value of something.

**calculate** Find a numerical answer.

**clarify** Make clear or plain.

**classify** Arrange into classes, groups or categories.

**comment** Give a judgement based on a given statement or result of a calculation.

**compare** Estimate, measure or note how things are similar or different.

**construct** Represent or develop in graphical form.

**contrast** Show how things are different or opposite.

**create** Originate or bring into existence.

**deduce** Reach a conclusion from given information.

**define** Give the precise meaning of a word, phrase or physical quantity.

**demonstrate** Show by example.

**derive** Manipulate a mathematical relationship(s) to give a new equation or relationship.

**describe** Give a detailed account.

**design** Produce a plan, simulation or model.

**determine** Find the only possible answer.

**discuss** Talk or write about a topic, taking into account different issues or ideas.

**distinguish** Give differences between two or more different items.

**draw** Represent by means of pencil lines.

**estimate** Find an approximate value for an unknown quantity.

**evaluate** Assess the implications and limitations.

**examine** Inquire into.

**explain** Make something clear or easy to understand.

**extract** Choose relevant and/or appropriate details.

**extrapolate** Infer from what is known.

**hypothesise** Suggest an explanation for a group of facts or phenomena.

**identify** Recognise and name.

**interpret** Draw meaning from.

**investigate** Plan, inquire into and draw conclusions about.

**justify** Support an argument or conclusion.

**label** Add labels to a diagram.

**list** Give a sequence of names or other brief answers.

**measure** Find a value for a quantity.

**outline** Give a brief account or summary.

**plan** Use strategies to develop a series of steps or processes.

**predict** Give an expected result.

**propose** Put forward a plan or suggestion for consideration or action.

**recall** Present remembered ideas, facts or experiences.

**relate** Tell or report about happenings, events or circumstances.

**represent** Use words, images or symbols to convey meaning.

**select** Choose in preference to another or others.

**sequence** Arrange in order.

**show** Give the steps in a calculation or derivation.

**sketch** Make a quick, rough drawing of something.

**solve** Work out the answer to a problem.

**state** Give a specific name, value or other brief answer.

**suggest** Put forward an idea for consideration.

**summarise** Give a brief statement of the main points.

**synthesise** Combine various elements to make a whole.

# Introduction

## What the book includes

This book provides questions and answers for each dot point in the Queensland Certificate of Education syllabus for the Year 12 Physics course:

- Unit 3 Gravity and Electromagnetism
  - Topic 6 Gravity and Motion
  - Topic 7 Electromagnetism
- Unit 4 Revolutions In Modern Physics
  - Topic 8 Special Relativity
  - Topic 9 Quantum Theory
  - Topic 10 The Standard Model

## Format of the book

The book has been formatted in the following way:

### 1.1 Subtopic from syllabus.

**1.1.1 Assessment statement from syllabus.**

**1.1.1.1** First question for this assessment statement.

**1.1.1.2** Second question for this assessment statement.

The number of lines provided for each answer gives an indication of how many marks the question might be worth in an examination. As a rough rule, every two lines of answer might be worth 1 mark.

## How to use the book

Completing all questions will provide you with a summary of all the work you need to know from the syllabus. You may have done work in addition to this with your teacher as extension work. Obviously this is not covered, but you may need to know this additional work for your school exams.

When working through the questions, write the answers you have to look up in a different colour to those you know without having to research the work. This will provide you with a quick reference for work needing further revision.

# Unit 3 Gravity and Electromagnetism

# Unit 3 Gravity and Electromagnetism

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# Unit 3 Gravity and Electromagnetism

# Unit 4 Revolutions In Modern Physics

# Unit 4 Revolutions In Modern Physics

## Unit 4 Revolutions In Modern Physics



SCIENCE AS A HUMAN ENDEAVOUR

The human endeavour subject matter will not be assessed in the external examination, but could be used in the development of claims and questions for a research investigation. Questions are not provided for these topics.

# Unit 4 Revolutions In Modern Physics

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# Unit 3

## Gravity and Electromagnetism

**In this unit you will:**

- **Investigate motion and its causes by using Newton's laws of motion and the gravitational field model.**
- **Analyse motion on inclined planes and the motion of projectiles and satellites.**
- **Explore the technologies behind artificial satellites and modern communication systems.**
- **Develop an understanding of electrical power generation and distribution systems.**
- **Learn about field theories of gravity and electromagnetism.**
- **Examine the production of electromagnetic waves.**

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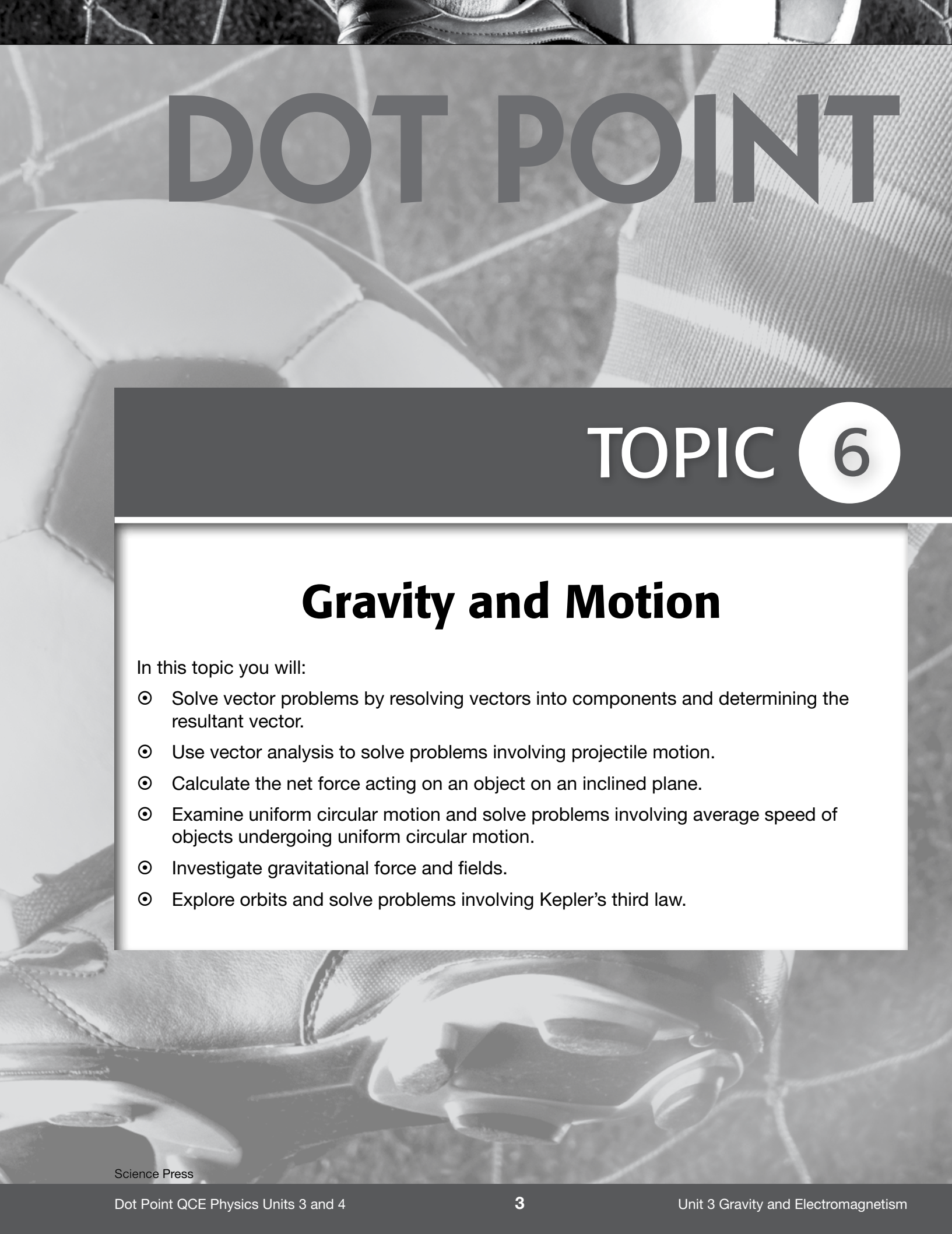

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TOPIC 6

# Gravity and Motion

In this topic you will:

- Solve vector problems by resolving vectors into components and determining the resultant vector.
- Use vector analysis to solve problems involving projectile motion.
- Calculate the net force acting on an object on an inclined plane.
- Examine uniform circular motion and solve problems involving average speed of objects undergoing uniform circular motion.
- Investigate gravitational force and fields.
- Explore orbits and solve problems involving Kepler's third law.

## 6.1 Use vector analysis to resolve a vector into two perpendicular components.

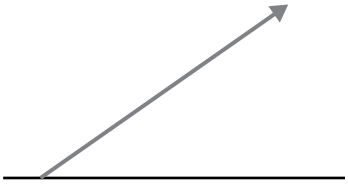
### 6.1.1 Components of vectors.

**6.1.1.1** Calculate the missing values in the table.

| Vector | Magnitude | Angle of inclination from horizontal | Horizontal component | Vertical component |
|---|---|---|---|---|
| 1 | 90 | 50 | A = | B = |
| 2 | 40 | 65 | C = | D = |
| 3 | E = | 35 | 30 | F = |
| 4 | G = | H = | 40 | 60 |
| 5 | 135 | I = | J = | 75 |

**6.1.1.2** Find the horizontal and vertical components of each of the following vectors. All vectors are drawn to a scale where 1 cm = 10 m.

(a)



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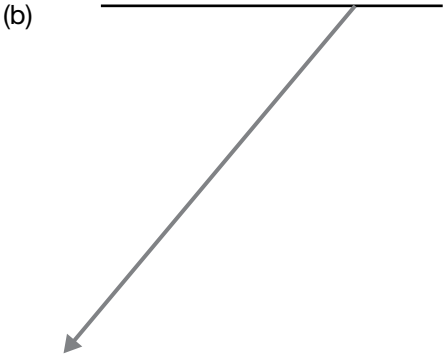

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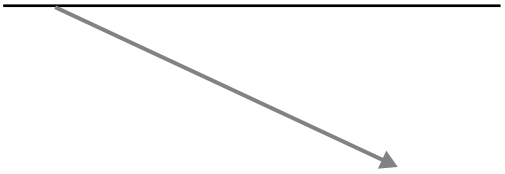

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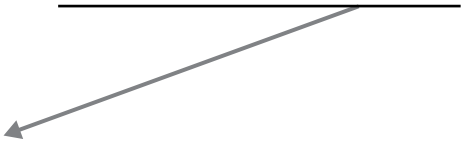

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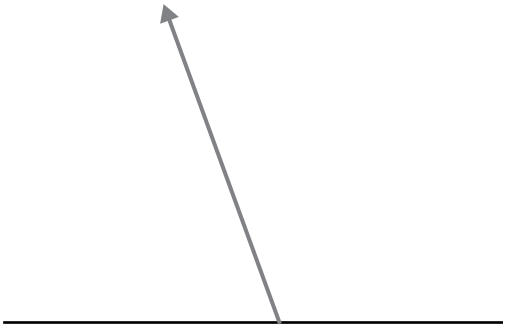

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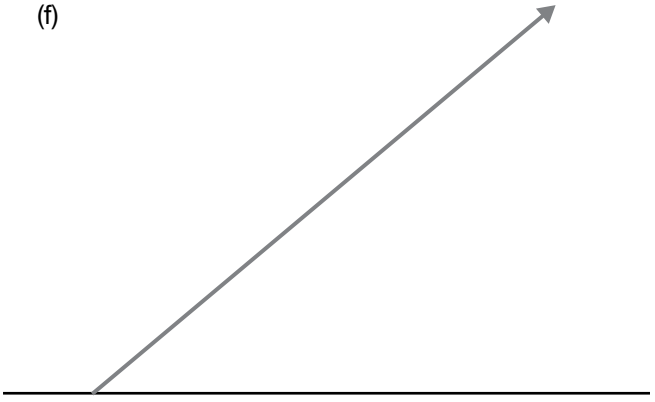


## 6.2 Solve vector problems by resolving vectors into components, adding or subtracting the components and recombining them to determine the resultant vector.

### 6.2.1 Adding vector components.

**6.2.1.1** The boxes show several pair of perpendicular vector components. Sketch vector diagrams to combine them to find the resultant vectors.

| | |
|---|---|
| (a) Horizontal component = 38 m E<br>Vertical component = 56 m N | (b) Horizontal component = 32 m W<br>Vertical component = 26 m S |
| (c) Horizontal component = 50 m E<br>Vertical component = 40 m N | (d) Horizontal component = 50 m W<br>Vertical component = 10 m S |
| (e) Horizontal component = 36 m E<br>Vertical component = 48 m S | (f) Horizontal component = 120 m E<br>Vertical component = 130 m N |

**6.2.2 Adding vectors in two dimensions 1.**

**6.2.2.1** Vector X is 12 N right, vector Y is 8 N right, and vector Z is 17 N right. What is:

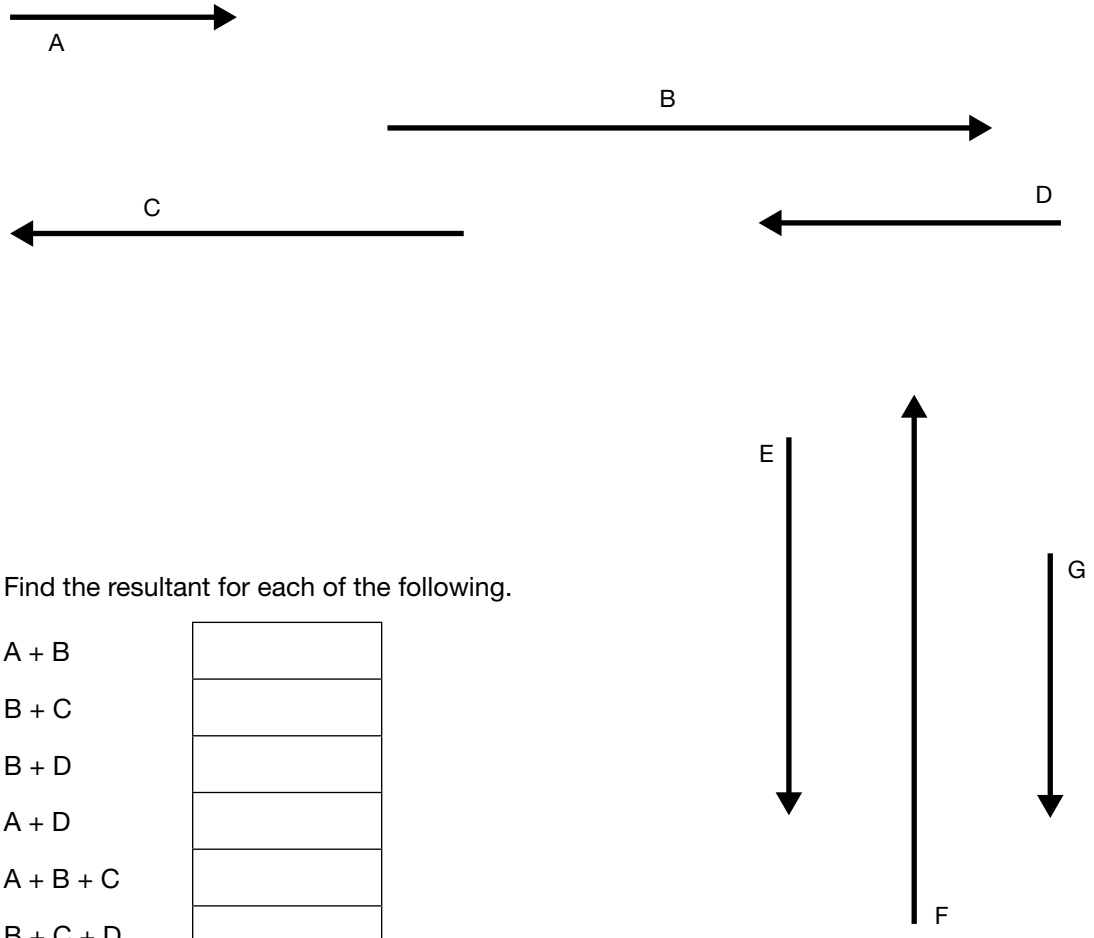
(a) X + Y? .....

(b) Y + Z? .....

(c) X + Z? .....

(d) X + Y + Z? .....

**6.2.2.2** The diagram shows several displacement vectors. Use them to answer the questions below them. The vectors have been drawn to a scale where 1 cm = 10 m.




Find the resultant for each of the following.

| | | |
|---|---|---|
| (a) | A + B | |
| (b) | B + C | |
| (c) | B + D | |
| (d) | A + D | |
| (e) | A + B + C | |
| (f) | B + C + D | |
| (g) | A + C + D | |
| (h) | A + B + C + D | |
| (i) | E + F | |
| (j) | F + G | |
| (k) | E + G | |
| (l) | E + F + G | |

### 6.2.3 Subtracting vectors in two dimensions 1.

**6.2.3.1** Vector X is 12 N right, vector Y is 8 N right, and vector Z is 17 N right. What is:

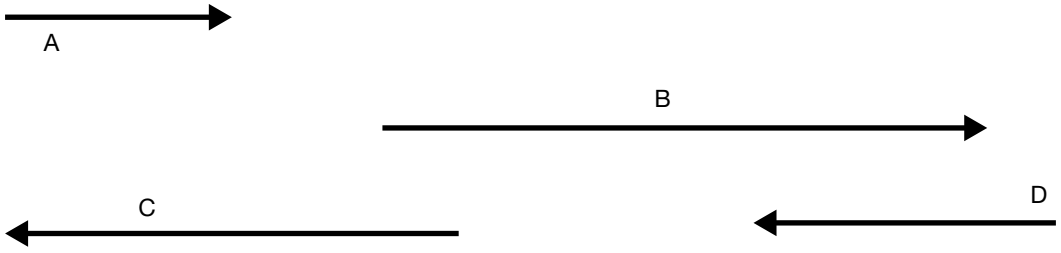
(a) X – Y? .....

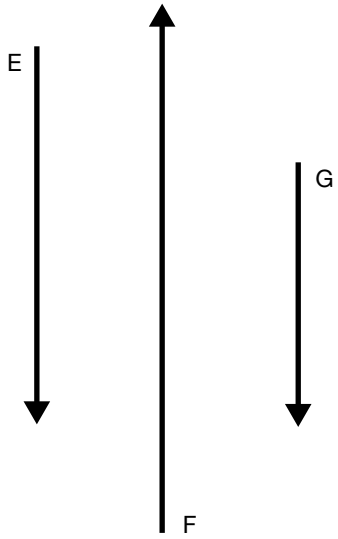
(b) Y – Z? .....

(c) X – Z? .....

(d) X – Y – Z? .....

**6.2.3.2** The diagram shows several displacement vectors. Use them to answer the questions below them. The vectors have been drawn to a scale where 1 cm = 10 m.




Find the resultant for each of the following.

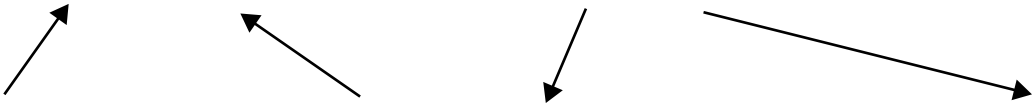
| | | |
|---|---|---|
| (a) | A – B | |
| (b) | B – C | |
| (c) | B – D | |
| (d) | A – D | |
| (e) | A – B – C | |
| (f) | B – C – D | |
| (g) | A – C – D | |
| (h) | A – B – C – D | |
| (i) | E – F | |
| (j) | F – G | |
| (k) | E – G | |
| (l) | E – F – G | |

**6.2.4 Adding vectors in two dimensions 2.**

**6.2.4.1** The diagram shows two vectors, P and Q.


Which choice best shows the vector addition P + Q?

(A) (B) (C) (D)



**6.2.4.2** Vector X is 500 m south. Vector Y is 200 m east. Vector Z is 400 m north east. What is X + Y + Z?

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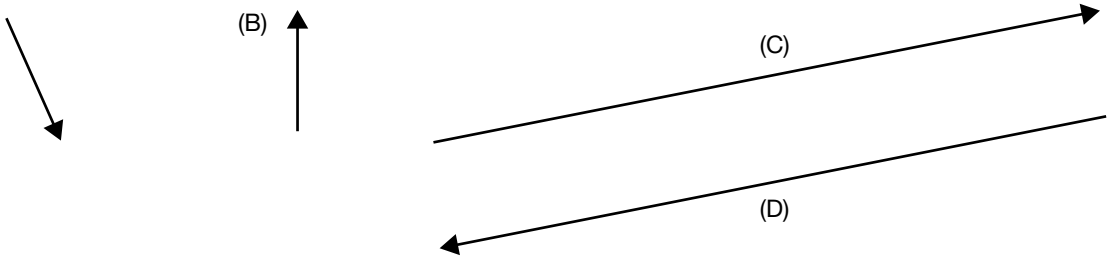
**6.2.4.3** The diagram shows two vectors, X and Y.


Which choice best shows vector Z = vector X + vector Y?

(A) (B)



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# Answers

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## Unit 3 Gravity and Electromagnetism

**6.1.1.1**

A = 57.9
B = 68.9
C = 16.9
D = 36.3
E = 36.6
F = 21.0
G = 72.1
H = 56.3
I = 112.2
J = 33.8

**6.1.1.2**

(a) Horizontal component = 32.8
Vertical component = 22.9

(b) Horizontal component = 38.6
Vertical component = 46.0

(c) Horizontal component = 45.3
Vertical component = 21.1

(d) Horizontal component = 47.0
Vertical component = 17.1

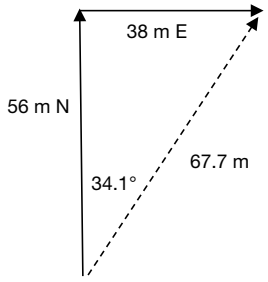
(e) Horizontal component = 15.4
Vertical component = 42.3

(f) Horizontal component = 61.3
Vertical component = 51.4

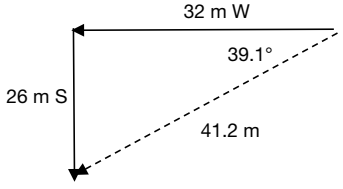
**6.2.1.1**

(*Note:* Vector sketches not to scale.)

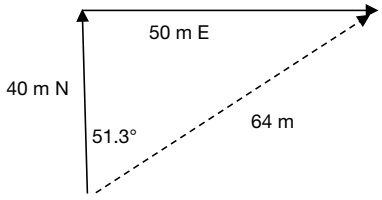
(a) Horizontal component = 38 m E
Vertical component = 56 m N



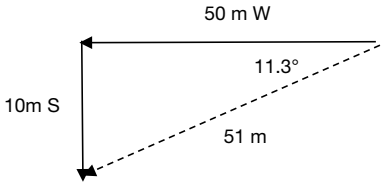

(b) Horizontal component = 32 m W
Vertical component = 26 m S



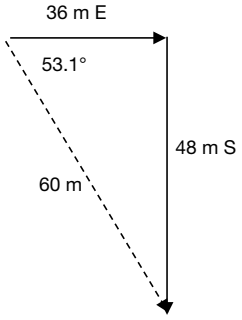

(c) Horizontal component = 50 m E
Vertical component = 40 m N



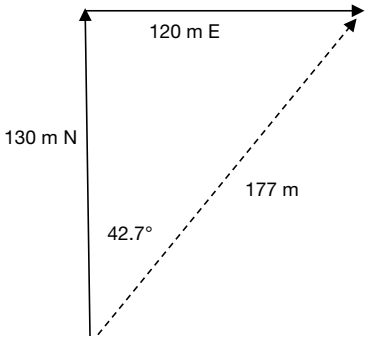

(d) Horizontal component = 50 m W
Vertical component = 10 m S




(e) Horizontal component = 36 m E
Vertical component = 48 m S




(f) Horizontal component = 120 m E
Vertical component = 130 m N




**6.2.2.1**

(a) 20 right
(b) 25 right
(c) 29 right
(d) 37 right

**6.2.2.2**

(a) 110 right
(b) 20 right
(c) 40 right
(d) 10 left
(e) 50 right
(f) 20 left
(g) 70 left
(h) 10 right
(i) 120 up
(j) 35 up
(k) 85 down
(l) 15 down