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N5

National Qualifications 2018

Mark

X847/75/01

Mathematics
Paper 1 (Non-Calculator)

FRIDAY, 4 MAY

9:00 AM – 10:15 AM

X8477501

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day Month Year

Scottish candidate number

Total marks — 50

Attempt ALL questions.

You may NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

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X8477501

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: $A = \frac{1}{2}ab\sin C$

Volume of a sphere: $V = \frac{4}{3}\pi r^3$

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Volume of a pyramid: $V = \frac{1}{3}Ah$

Standard deviation: $s = \sqrt{\dfrac{\Sigma(x - \bar{x})^2}{n - 1}}$

or $s = \sqrt{\dfrac{\Sigma x^2 - \dfrac{(\Sigma x)^2}{n}}{n - 1}}$, where n is the sample size.

MARKS | DO NOT WRITE IN THIS MARGIN

Total marks — 50

Attempt ALL questions

1. Evaluate $2\frac{1}{3}+\frac{4}{5}$. **2**

2. Expand and simplify $(3x+1)(x-1)+2(x^2-5)$. **3**

MARKS DO NOT WRITE IN THIS MARGIN

3. Solve, algebraically, the system of equations

$$4x+5y=-3$$
$$6x-2y=5.$$

3

4. Two vectors are given by $\mathbf{u}=\begin{pmatrix}1\\5\\1\end{pmatrix}$ and $\mathbf{u}+\mathbf{v}=\begin{pmatrix}6\\-4\\3\end{pmatrix}$.

Find vector $\mathbf{v}$.

Express your answer in component form.

2

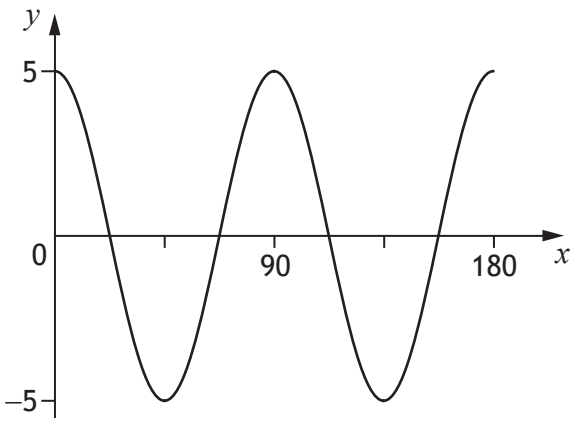
MARKS DO NOT WRITE IN THIS MARGIN

5. Solve

$$x^2 - 11x + 24 = 0 .$$

2

6. Part of the graph of $y = a\cos bx°$ is shown in the diagram.

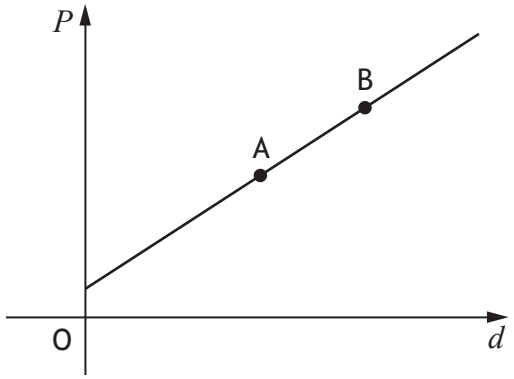


State the values of a and b.

2

7. The cost of a journey with Tom's Taxis depends on the distance travelled.

The graph below shows the cost, P pounds, of a journey with Tom's Taxis against the distance travelled, d miles.



Point A represents a journey of 8 miles which costs £14.

Point B represents a journey of 12 miles which costs £20.

(a) Find the equation of the line in terms of P and d.

Give the equation in its simplest form. **3**

MARKS DO NOT WRITE IN THIS MARGIN

7. (continued)

(b) Calculate the cost of a journey of 5 miles. **1**

8. Determine the nature of the roots of the function $f(x) = 2x^2 + 4x + 5$. **2**

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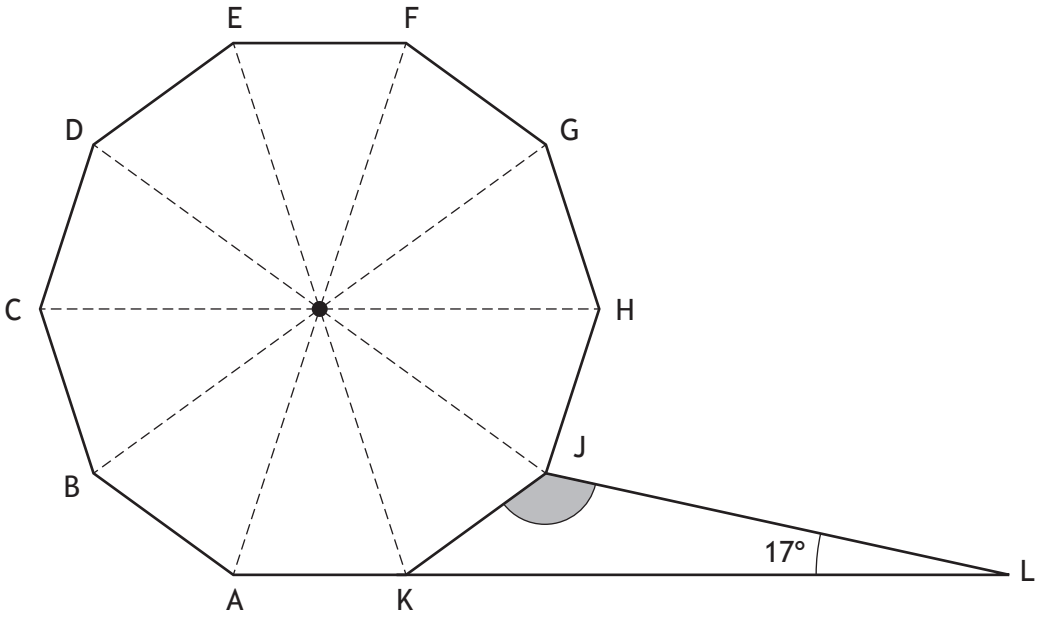
9. In the diagram shown below, ABCDEFGHJK is a regular decagon.

- Angle KLJ is 17°.
- AKL is a straight line.

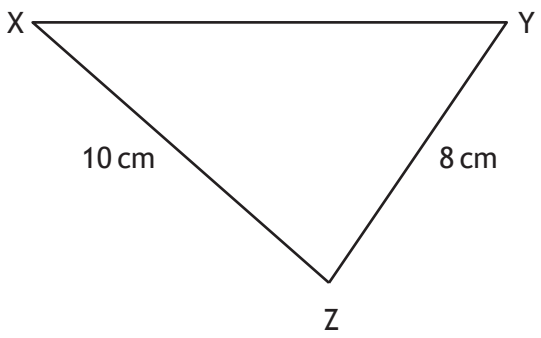


Calculate the size of shaded angle KJL. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

10. In triangle XYZ:

- XZ = 10 centimetres
- YZ = 8 centimetres
- $\cos Z = \frac{1}{8}$.



Calculate the length of XY. **3**

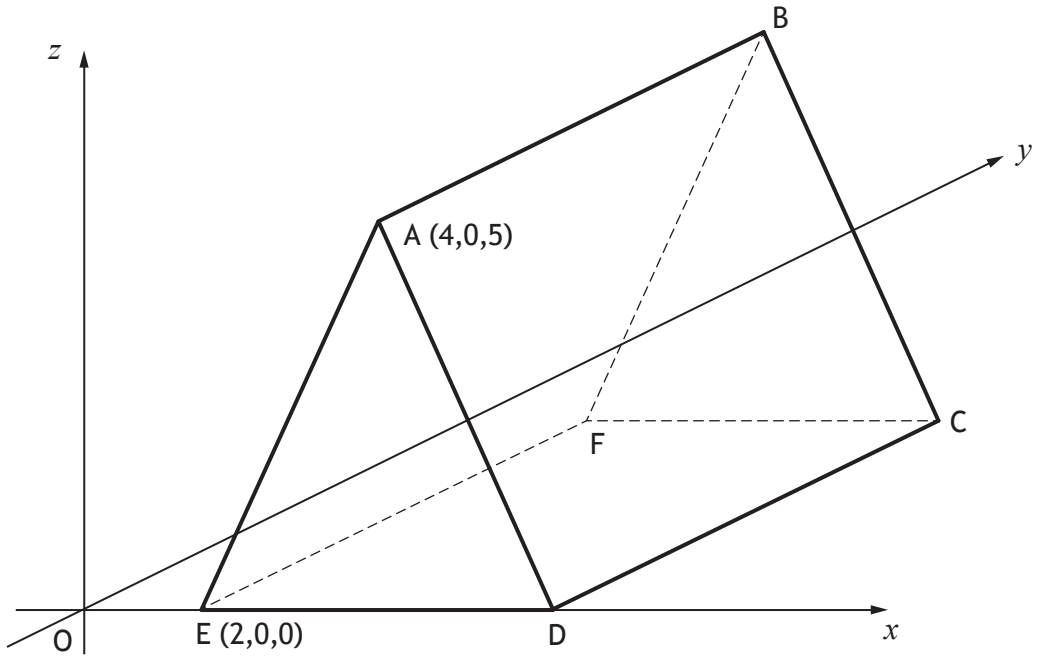
MARKS | DO NOT WRITE IN THIS MARGIN

11. Express $\frac{9}{\sqrt{6}}$ with a rational denominator.

Give your answer in its simplest form. **2**

12. Given that $\cos 60° = 0{\cdot}5$, state the value of $\cos 240°$. **1**

13. The diagram shows a triangular prism, ABCDEF, relative to the coordinate axes.



- AD = AE.
- DC = 8 units.
- Edges EF, DC and AB are parallel to the y-axis.

Write down the coordinates of B and C. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

14. Change the subject of the formula $y = g\sqrt{x} + h$ to x. **3**

15. Remove the brackets and simplify $\left(\frac{2}{3}p^4\right)^2$. **2**

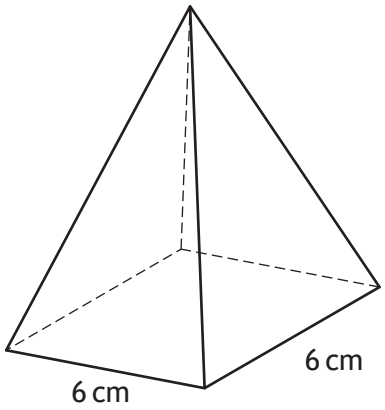
MARKS | DO NOT WRITE IN THIS MARGIN

16. Sketch the graph of $y = (x-6)(x+4)$.

On your sketch, show clearly the points of intersection with the x-axis and the y-axis, and the coordinates of the turning point. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

17. A square based pyramid is shown in the diagram below.



The square base has length 6 centimetres.

The volume is 138 cubic centimetres.

Calculate the height of the pyramid. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

18. Express $\sin x° \cos x° \tan x°$ in its simplest form.

Show your working. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

19. (a) (i) Express $x^2 - 6x - 81$ in the form $(x - p)^2 + q$. **2**

(ii) Hence state the equation of the axis of symmetry of the graph of $y = x^2 - 6x - 81$. **1**

MARKS DO NOT WRITE IN THIS MARGIN

19. (continued)

(b) The roots of the equation $x^2 - 6x - 81 = 0$ can be expressed in the form $x = d \pm d\sqrt{e}$.

Find, algebraically, the values of d and e. **4**

[END OF QUESTION PAPER]

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ADDITIONAL SPACE FOR ANSWERS

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National Qualifications 2018

Mark

X847/75/02

Mathematics Paper 2

FRIDAY, 4 MAY

10:35 AM – 12:25 PM

X8477502

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day Month Year

Scottish candidate number

Total marks — 60

Attempt ALL questions.

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X847750201

FORMULAE LIST

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Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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MARKS | DO NOT WRITE IN THIS MARGIN

Total marks — 60

Attempt ALL questions

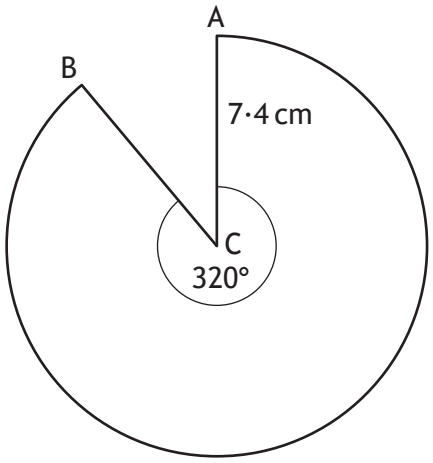
1. Households in a city produced a total of 125 000 tonnes of waste in 2017.

The total amount of waste is expected to fall by 2% each year.

Calculate the total amount of waste these households are expected to produce in 2020. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

2. The diagram below shows a sector of a circle, centre C.



The radius of the circle is 7·4 centimetres.

Calculate the length of the major arc AB. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

3. Find $|\mathbf{r}|$, the magnitude of vector $\mathbf{r} = \begin{pmatrix} 24 \\ -12 \\ 8 \end{pmatrix}$. **2**

4. Solve, algebraically, the inequation

$$3x < 6(x-1) - 12.$$ **3**

MARKS DO NOT WRITE IN THIS MARGIN

5. A farmers' market took place one weekend.

Stallholders were asked to record the number of customers who visited their stall.

The number of customers who visited six of the stalls on Saturday were as follows:

120 126 125 131 130 124

(a) Calculate the mean and standard deviation of the number of customers. **4**

5. (continued)

The mean number of customers who visited these six stalls on Sunday was 117 and the standard deviation was 6·2.

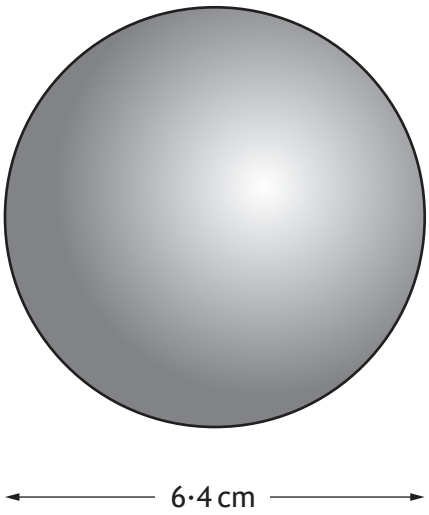
(b) Make two valid comments comparing the number of customers who visited these stalls on Saturday and Sunday. **2**

6. A function is defined as $f(x) = 5 + 4x$.

Given that $f(a) = 73$, calculate a. **2**

MARKS DO NOT WRITE IN THIS MARGIN

7. A toy company makes juggling balls in the shape of a sphere with a diameter of 6·4 centimetres.



Calculate the volume of one juggling ball.

Give your answer correct to 2 significant figures. **3**

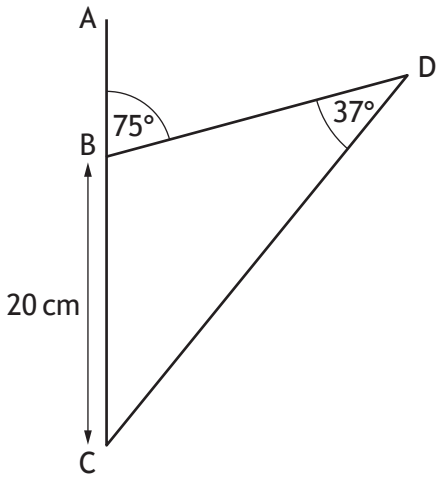
MARKS | DO NOT WRITE IN THIS MARGIN

8. Solve the equation $7\sin x° + 2 = 3$, for $0 \leq x < 360$. **3**

MARKS DO NOT WRITE IN THIS MARGIN

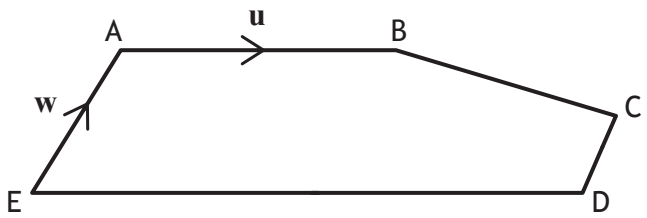
9. In this diagram:

- angle ABD = 75°
- angle BDC = 37°
- BC = 20 centimetres.



Calculate the length of DC. **3**

10. In the diagram below, $\overrightarrow{AB}$ and $\overrightarrow{EA}$ represent the vectors $\mathbf{u}$ and $\mathbf{w}$ respectively.



- $\overrightarrow{ED} = 2\overrightarrow{AB}$
- $\overrightarrow{EA} = 2\overrightarrow{DC}$

Express $\overrightarrow{BC}$ in terms of $\mathbf{u}$ and $\mathbf{w}$.

Give your answer in its simplest form. **2**

MARKS DO NOT WRITE IN THIS MARGIN

11. Venus and Earth are two planets within our solar system.

Venus

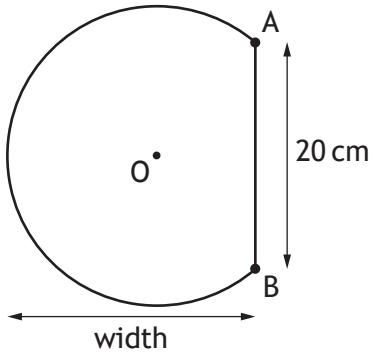
Earth

The volume of Venus is approximately $9{\cdot}3 \times 10^{11}$ cubic kilometres.

This is 85% of the volume of Earth.

Calculate the volume of Earth. **3**

12. The shape below is part of a circle, centre O.



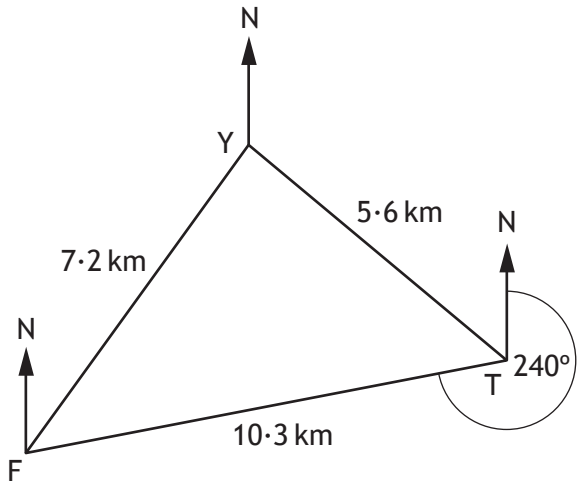
The circle has radius 13 centimetres.

AB is a chord of length 20 centimetres.

Calculate the width of the shape. **4**

13. A ferry and a trawler receive a request for help from a stranded yacht.

On the diagram the points F, T and Y show the positions of the ferry, the trawler and the yacht respectively.



- FY is 7·2 kilometres.
- TY is 5·6 kilometres.
- FT is 10·3 kilometres.
- F is on a bearing of 240° from T.

Calculate the bearing of the yacht from the trawler. **4**

14. A straight line has equation $2x - 5y = 20$.

Find the coordinates of the point where this line crosses the y-axis. **2**

15. Express

$$\frac{n}{n^2 - 4} \div \frac{3}{n - 2}, \quad n \neq -2, n \neq 2$$

as a single fraction in its simplest form. **3**

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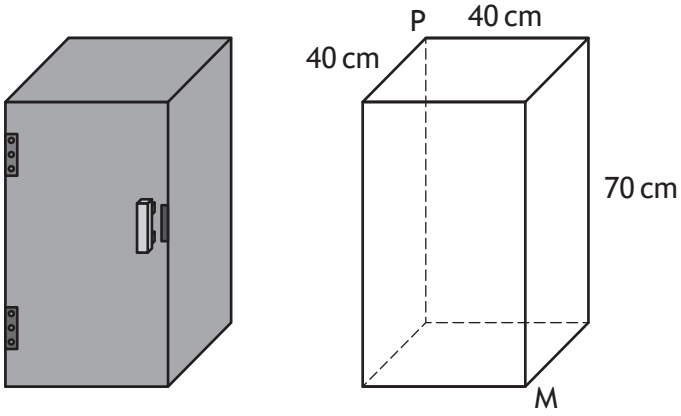
16. Chris wants to store his umbrella in a locker.

The locker is a cuboid with internal dimensions of length 40 centimetres, breadth 40 centimetres and height 70 centimetres.



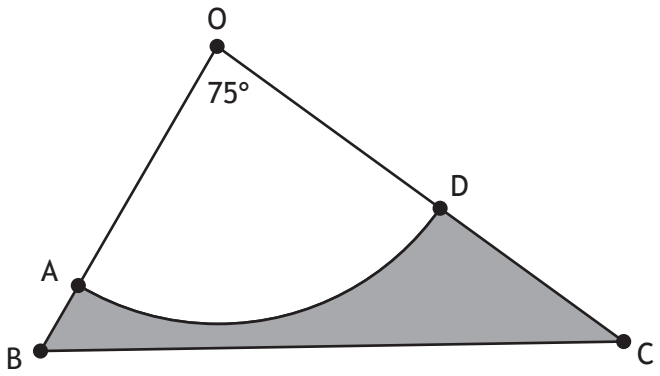
The umbrella is 85 centimetres long.

He thinks it will fit into the locker from corner P to corner M.

Is he correct?

Justify your answer. **4**

17. In the diagram below AOD is a sector of a circle, with centre O, and BOC is a triangle.



In sector AOD:

- radius = 30 centimetres
- angle AOD = 75°.

In triangle OBC:

- OB = 38 centimetres
- OC = 55 centimetres.

Calculate the area of the shaded region, ABCD. **5**

MARKS DO NOT WRITE IN THIS MARGIN

18. A cinema sells popcorn in two different sized cartons.

The small carton is 16 centimetres deep and has a volume of 576 cubic centimetres.

The large carton is 24 centimetres deep and has a volume of 1125 cubic centimetres.

(a) Show that the two cartons are **not** mathematically similar. **3**

MARKS DO NOT WRITE IN THIS MARGIN

18. (continued)

The large carton is redesigned so that the two cartons are **now** mathematically similar.

The volume of the redesigned large carton is 1500 cubic centimetres.

(b) Calculate the depth of the redesigned large carton. **2**

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ACKNOWLEDGEMENTS

Question 11 – Venus: Dotted Yeti/Shutterstock.com
Earth: TeddyGraphics/Shutterstock.com

Question 18 – Popcorn carton: Richard Peterson/Shutterstock.com