

Past-paper walk-through

Surface area and volume ■ E5.4

eXercise

Questions in this set

- 0580/41 N25 Q14 ■ 7 marks
- 0580/41 J25 Q20 ■ 9 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 14

0580/41 N25 ■ Q14 ■ 7 marks

- 14** A cube contains a solid metal sphere.
The sphere touches all the faces of the cube.
The side length of the cube is 8 cm.

(a) Show that the volume of the sphere is $\frac{256}{3}\pi \text{ cm}^3$.

Question 14

[1]

- (b) Calculate the percentage of the cube that is **not** occupied by the sphere.

Question 14

- (c) The density of the metal of the sphere is 7.86 g/cm^3 .

Calculate the mass of the sphere.

Give your answer in kilograms.

[Density = mass $\div$ volume]

Question 14

- (d) The sphere is melted down and made into a solid cylinder with radius 3.1 cm.

Calculate the **total** surface area of the cylinder.

Question 14

Question 14

Solution 14

(a) Mark scheme

- 3

- 4

-

- 4

- 3 × ×

= 256 ■

- 1

Solution 14

(b) Mark scheme

- 47.6 nfw or
- 47.63 to 47.64... nfw
- 3 B2 for 52.4 or 52.35 to 52.37 or $50/3$ nfw
- OR M2
- for
- 3
- 3
- 256

Solution 14

- 8
-
- 3
- 100
- 8
- —
- $\times$
- oe
- or M1 for
- 3

Solution 14

- 3

- 256

- 8

-

- 3

100

- 8

- —

- ×

- oe or

Solution 14

- 3
- 256
- 3
- 100
- 8
- $\times$
- oe

Solution 14

(c)

Mark scheme

- 2.11 or 2.107...
- 2 M1 for $256 \div 7.86$
- 3
- $\times$

Solution 14

(d) Mark scheme

- 233 or 233.3 to 233.4
- 4 M1 for
- 2
- 256
- 3.1
-
- 3
- h

Solution 14

- $\times$
- $\times$
- $=$
- M2dep for
- 2
- 2
-
- 3.1
- 2
-

Solution 14

- 3.1 their h
- $\times$
- $\times$
- $+$ $\times$
- $\times$
- $\times$
- or M1dep for 2 3.1 theirh
- $\times \times$
- $\times$
- or M1 for

Solution 14

- 2
- 2
- 3.1
- $\times$
- 0580/41
- October/November 2025
- Partial Marks
- 15
- 46
- 3 M2 for $[\text{angle ATB}] = 180 - 2 \times 67$ oe

Solution 14

- OR (M1)
- for [obtuse] angle $AOB = 2 \times 67$ (M1)
- for angle OAT or angle $OBT = 90$
- OR (M1)
- for angle $TBA = 67$ or angle $TAB = 67$ (M1)
- for angle TDA or $TDB = 90$ where D is the
- intersection of OT and AB
- OR (M1)
- for angle $BOT = 67$ or angle $AOT = 67$ (M1)
- for angle $OTB = 180 - 67 - 90$ or

Solution 14

- angle $OTA = 180 - 67 - 90/16$ 13.09
- 4 M1 for mid-values 7.5, 11 and 16 soi (M1)
- for Σfx where x-values in correct interval
- (including boundaries)
- M1dep on second M1 for 50
- Σfx
- 17

$$y = -2x + 4$$

- 3 M1 for gradient = 4/0
- 0

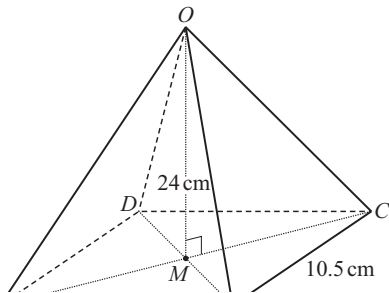
Solution 14

- 2
- —
- —
- oe M1
- for answer $mx + 4$

Question 20

0580/41 J25 ■ Q20 ■ 9 marks

20

NOT TO
SCALE

Question 20



The diagram shows a pyramid $OABCD$.

The pyramid has a square base, $ABCD$, with sides 10.5 cm.

The vertex O is vertically above the centre of the base, M .

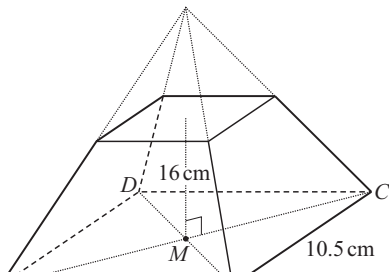
The height of the pyramid is 24 cm.

- (a) Calculate the angle that OA makes with the base.

Question 20

Question 20

(b)



NOT TO
SCALE

Question 20

11 10.5 cm 2

The diagram shows a frustum of the pyramid $OABCD$.
The height of the frustum is 16 cm.

Calculate the volume of the frustum.

Question 20

Question 20

Question 21 is on page 16.

Solution 20

(a) Mark scheme

- 72.8 or 72.81...
- 4 M3 for
- 2
- 2
- 24
- 1 10.5
- 10.5
- 2

Solution 20

- +
- oe or better
- or M2 for AM =
- 2
- 2
- 1 10.5
- 10.5
- 2
- +
- oe

Solution 20

- or
- $10.5 \cos 45$
- $=$
- AM
- oe
- or M1 for $AC^2 = 10.5^2 + 10.5^2$
- or AM 2 = $5.25^2 + 5.25^2$
- or
- $\cos 45$
- $10.5 =$

Solution 20

- AM
- oe
- If 0 scored, SC1 for identifying OAM

Solution 20

(b) Mark scheme

- 849 1
- 3
- or 849 or 849.3...
- 5 Method 1 **B2**
- for side of small square = 3.5
- or M1 for 10.5
- 24
- 24 16

Solution 20

- $\times$
- $=$
- $-$
- or better M2
- for 1
- $3 \times 10.52 \times 24 - 1$
- $3 \times (\text{their } 3.5)^2 \times$
- $(24 - 16)$
- or M1 for 1
- $3 \times 10.52 \times 24$

Solution 20

- or for 1
- $3 \times (\text{their } 3.5)^2 \times (24 - 16)$
- Method 2 **B2**
- for 1
- 27 or $26/27$ or M1 for volume scale factor =
- 3
- 24 16
- 24
- —
- (

Solution 20

-)
- (
-)
- (
-) M2
- for
- 2
- 1
- 1
- 1

Solution 20

■ 10.5

■ 24

■ 27

■ 3

■ (

■)

■ —

■ ×

■ ×

■ ×

Solution 20

- (
-)
- (
-)
- their
- oe
- or M1 for
- 2
- 1 10.5
- 24

Solution 20

- $3\times$
- $\times$
- or
- 2
- 1
- 1
- 10.5
- 24
- 27
- 3

Solution 20

- their

- $\times$

- $\times$

- $\times$

- oe

- 21

$$m = 6/1$$

- 10

- +

- n

Solution 20

- oe
- 3 M2 for $2(5m) - 1 = 3(2n)$ oe or better
- or M1 for $42(5m)$ or for $43(2n)$ oe or better
- 0580/41
- May/June 2025
- Partial Marks
- 22
- 4.4 nfww
- 3 M2 for 50 to 60/13 0.5
- —

Solution 20

- or $50/5$ 12 to 13
- +
- oe
- or M1 for $50 + 5$, $50 - 5$, $13 + 0.5$ or
- $13 - 0.5$ seen